ENGINEERING NEWS

THE pneumatic foundation for the new Harlem bridge was completed last week with the caisson filled with concrete and the filling of the shafts commenced. This caisson rests with its cutting-edge 41 ft. 3 in. below mean high water and carries 28 ft. of masonry on the deck, or roof. Work upon the main piers will now be pushed and it is expected that by Aug. 1, at the latest, the erection of the iron work for the main span can be commenced.

ADVICES from the Hawkesbury bridge, to date of April 13, state that the foundations for piers 4 and 5 were then sunk respectively somewhat over 80 and 90 ft. below the bed of the river, and the work was progressing without a hitch. At the piers named the water is about 20 ft. deep, and the lower chord of the truss is 42 ft. above high water; it would then mean that these two foundations were about 142 and 152 ft. below the lower chord. The borings near the sites of these piers call for 163 and 184 ft. below the lower chord, thus leaving about 20 and 30 ft. further to go to reach the "hard sediment" stratum at which it is proposed to stop.

THE successful application of the Shone hydro-pneumatic system of sewerage to the Houses of Parliament, in London, has called renewed attention to its peculiar features, and Mr. URBAN H. BROUGHTON, Assoc. M. Inst. C. E., is now in this country as the representative of Mr. SHONE and with the intent of extending its use here. The system doubtless has inherent merits, and while it would seem to be somewhat expensive in extended application the thorough character of the work done would well warrant all the expenditure required. Its chief features may be summarized as follows:—The division of the district under treatment into as many natural drainage areas as desirable; a system of small, smooth and tight pipes converging to an injector station; the raising of the sewage as fast as it accumulates at this central station, by compressed air, into a sealed iron main, and its rapid conveyance under pressure to the point of ultimate disposal. The advantages are that it handles the sewage at once, before decomposition can set in; will force it over undulating gradients, thus under certain conditions of topography reducing the depths at which mains must be laid; fills the system of mains with fresh air, instead of the usual foul sewage gases; its service can be increased to meet a growing demand by simply putting in additional ejectors; the sewage can be more rapidly and certainly conveyed to the main ejector station by the use of supplemental house-sewage ejectors, and finally it can be applied as an adjunct to existing sewerage systems.

BERLIN has a metropolitan railway of which little has been said in this day of rapid transport. It was built 1875–82, and is a circular road uniting the east and west railway systems centering at Berlin. The four-track viaduct is carried mainly on brick arches of 42 ft. span, with iron bridges over streets, etc. It is 52½ ft. wide and 7.2 miles long; with two of its tracks devoted entirely to local traffic and two to the passenger service of the trunk lines. The arches are let out as shops and work-shops and command high rent. The new type of engines used weigh 34⅕ tons, and are smoke-consuming; the speed is limited to 28 miles per hour and trains run at 10 minute intervals usually and 5 minutes on *fête* days. The local traffic is about 30,000 per day. The third-class fare is 5 cts. between stations (of which there are ten), or 10 cts. for the whole course; second-class tickets are 5 cts. in addition. The road was built by the Government and cost $18,771,000; of which sum $8,800,000 was paid for property.

THE Abt system of combined traction and rack-rail for mountain service, as applied at Blankenberg in the Hartz mountains, is attracting attention elsewhere. Engineers have reported upon it with a view to its utilization in Bosnia; it has been adopted for the Puerto Cabello Railway in Venzuela, and it is said that the plan is to be carried out for a railway in Afghanistan. At any event the Dortmund Company is now making 47,000 metres of the toothed rail for foreign use.

As a result of the International Congress of Geologists, called through the united efforts of leading American and Canadian geologists in 1876, we are soon to have a new geological map of Europe. This Congress held sessions in Paris (1878), Bologna (1881), and Berlin (1884). The second congress confided to a special committee the work of producing a map on a scale of 1: 1,500,000 from the latest geographical and topographical data accessible, "published and unpublished," and the contract for printing it is now let to REIMER & CO., of Berlin. The map will appear in 49 sheets, each 19 x 21 in., and they may be used separately or as one map about 11 x 12 ft. France, Spain, Italy, Austro-Hungary, Russia, Scandinavia, Germany and Great Britain has the right to 100 copies of the complete map at 100 francs a copy, and the American Committee is now endeavoring to get the names of 100 institutions or individuals to subscribe for an equal number of maps. Further information can be obtained from Dr. PERSIFOR FRAZER, Philadelphia, Pa.

JOHN GILMER SPEED, the Secretary of the American Exhibition in London, answers the financial exhibit of *The Engineer*, referred to in our last issue, practically as follows:—That the exhibition is paying in cash as it goes; that $300,000 has been called and expended in the work of preparation or building, from the $375,000 already allotted. And that in addition to this reserve of $75,000 they are daily receiving further sums from the sale of space, which source will yield before May 1 at least $100,000. The deferred shares are to be used in paying the salaries of the chief officers of the exhibition.

THE Coast Survey has started four parties in the field to complete the "transcontinental geodetic arc." Its original base is a stone monument on Kent Island, opposite Annapolis, Md.; thence the arc is carried through Parkersburg to Cincinnati. From St. Louis the line has been run east to within 90 miles of Cincinnati, and another extends from Kansas City to Salina, and another still from Colorado Springs to within 300 miles of Salina. On the Pacific coast, the arc is run from San Francisco, through Sacramento into Nevada and south of Salt Lake City. The parties sent out are to work in Ohio, Indiana, Colorado and Utah upon the gaps indicated. The Pacific triangulation is the most complete and the sides of some of the triangles are the longest ever used in this work. A side of 168 miles was used in the France-Algiers survey, and it made M. PERRIER a Member of the French Academy, but the line from Mt. Shasta to Mt. St. Helena is 192 miles long.

THE talk of widening Elm street, just east of Broadway, now a narrow alley with ugly grades, has been renewed. The raising of the grades and widening of the streets would have the indirect advantage of facilitating the construction of an underground line which for over a mile of the most difficult work from Chambers street to Broome street could be laid nearly on the present surface before raising the grade. The carrying through of the project would greatly improve a section of the city which is now in very backward condition.

THE most serious railroad accident of the week occurred April 20, and was caused by the breaking of a drawbar on a freight train, while being hauled up a grade on the main line of the Louisville, Evansville & St. Louis Air Line Railroad, near Taswell, Ind. The rear section ran down the grade, jumped the track and was wrecked. Three men were killed and two fatally injured.

The floods are subsiding in most places, and there has not been much serious damage caused by them this week. The Rideau river in Canada has overflowed and Saratoga lake has flooded the Boston, Hoosac Tunnel & Western Railroad. One highway and three railroad bridges have been wrecked and three highway bridges injured. Snow has caused delay to traffic in Pennsylvania. Landslides have occurred on the New York Central, West Shore, West Pennsylvania, Central Vermont, Louisville & Nashville, Chicago, Milwaukee & St. Paul, Pennsylvania, Allegheny Valley and Northern Pacific railroads. Three trains have been wrecked by landslides. A tornado caused much damage in Belmont county, O., April 14; and another in Isle of Wight county, Va., April 18.

The worst landslide, that at Canajohaire, N. Y., on the New York Central, we are enabled to illustrate in this issue by the kindness of Professor CHARLES C. BROWN, of Union College, Schenectady.

THE *Arrow-Mayflower* yacht race is off, but it has been pointed out by that bright little paper, the *Evening Sun*, that Mr. TANKERVILLE CHAMBERLAYNE, owner of the *Arrow* and holder of the Queen's cup, was unnecessarily rude in abbreviating his despatch merely to save expense. Instead of saying:

"Very sorry, *Arrow* cannot possibly concede great advantage of unrestricted centerboard.
CHAMBERLAYNE."

The *Sun* well says that he should "have sent the full message intended regardless of high cable rates, which was:

"Very sorry, *Arrow* cannot possibly concede great advantage of unrestricted centerboard—and win.
CHAMBERLAYNE."

THE death roll of the new aqueduct has grown still longer. Drilling on an unexploded cartridge: Two killed and four injured.

THE Massachusetts Railroad Commission have not yet found out anything which they are ready to tell about the fall of the Bussey bridge.

Important if True.

Washington Letter to the Kansas City Journal

A Mr. TAINTER, who has long been associated with Professor ALEXANDER GRAHAM BELL, of telephone fame, has taken up the EDISON phonograph at the point where he left it, and developed it from a toy to an article of commercial value. Before long it will be given to the public.

It is constructed on the same principle as the phonograph, but instead of giving out a squeaking, metallic sound, as when the sheet of tin foil was used, it now produces a full, sonorous sound, which can be distinctly heard and understood in any part of an ordinary room. The conversation is recorded upon thin sheets of wax in shape of a tube placed upon a cylinder. One of these little tubes will hold 1,000 words.

A merchant who has forty letters to answer, can sit before one of these machines, turn the crank, and talk his answers directly into the machine, which records them upon the wax tube in the same manner as in the old phonograph. Afterward one of these little tubes can be slipped off the cylinder and sent by mail to any part of the country. When received it will only be necessary to put the wax tube into a similar machine and it will reproduce the words of the original speaker as often as may be wished.

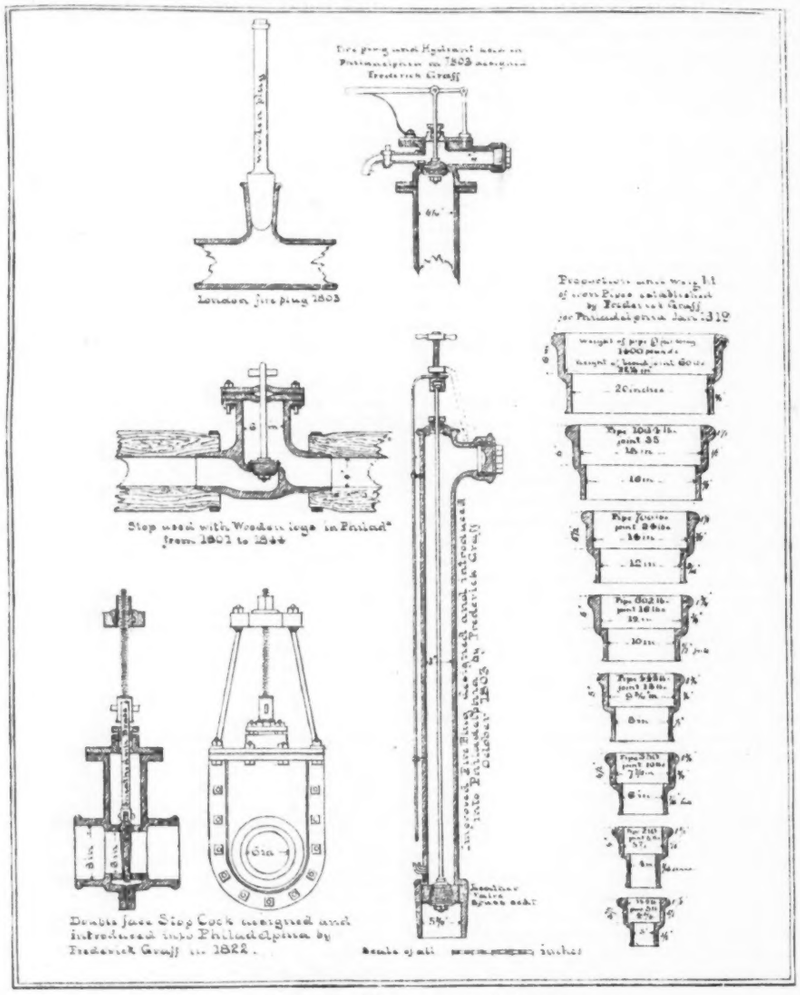
Tubes, or envelopes, in which to inclose these wax tubes have been accepted by the Post-office Department for transmission through the mails. The thin wax tubes for use in the graphophone will be on sale at all stationery stores at about the same rate as letter paper. As soon as this machine comes into general use it will make every one his own amanuensis, doing away with the necessity for a private secretary, a stenographer, a tpyewriter. And it will be a preventative of forgery, since it reproduces the exact voice of the speaker so that those who are familiar with it will recognize it at once.

A CORRESPONDENT of the *Albany Journal* who is opposed to the Poughkeepsie bridge in the Hudson, makes rather a good point on the opinion of Gen. NEWTON, as Chief of Engineers, that the "cross-section remaining after the piers are placed, would still be more than that of the natural river at Blue Point below. The correspondent admits that the river is wider at Poughkeepsie by 750 ft., but objects to the implied freedom to navigation as follows:—As the river is 15 times 50 ft. wider at the bridge than at Blue Point, you might put in 15 piers 50 ft. wide, or 50 piers 15 ft. wide, or 100 piers 7½ ft. wide, or, indeed, you might drive 750 spikes of steel each a foot in diameter across the river, in which case the spaces would each be less than 4 ft., yet the aggregate of the spaces would be equal to the natural river at Blue Point, and *hence* the navigation equally free in both places. This is the argument of Gen. NEWTON carried out; yet we can go one step further and imagine the General setting up a huge sieve across the highway, and when you come up in your carriage, and ask him to remove it and let you pass, he coolly answers: "You have no cause for complaint. The aggregate of the holes in this concern is equal to a full-sized toll-gate. Proceed to sift yourself through."

Early American Pumping and Distribution Plant.

(*Concluded from page 248.*)

Plate 3 shows some parts of the water distribution plant designed by the elder Mr. Graff for Philadelphia. The pipe used generally until 1819 was made of bored spruce-pine logs, banded with wrought-iron at the ends. The "standard" thickness and weights of cast-iron pipes as shown is interesting, and the stop used with the wooden logs embodies the general arrangement of the "globe valves" of the present day. The fire-hydrants and stop-cock


London fire plug 1803
Stop used with Wooden logs in Philad.a from 1802 to 1844
Double face Stop Cock designed and introduced into Philadelphia by Frederick Graff in 1822.

Water-pipe, Valves, etc. in 1803–23.

designed by Mr. Graff in 1803, also contain the general principles and almost the mechanical form of their many successors of to-day.

The first of the Philadelphia iron mains were cast by Samuel Richards, Philadelphia, June, 1820, and were laid at Broad and Market streets. These were made at a charcoal blast furnace on the specifications drawn up Jan. 26, 1816, by Frederick Graff, Sen., and were in constant use for 53 years. The price paid was about 5 cts. per pound.

Sewerage.—Newburyport, Mass. The Council is discussing the act to inporporate the Newburyport Sewage Co., which is the first of its kind in the state; George H. Norman, of Boston, is at the head of the project.——Troy, N. Y. A bill has been passed providing for the construction of certain sewers.——San Antonio, Tex. Bonds for $50,000 will be issued for new sewers.——Brunswick, Ga. Jeter & Bordman propose to put in a sewerage system for $48,000, to be paid in twelve annual instalments of $4,000. Amsterdam, N. Y. Governor Hill has signed the bill for a system of sewers.——Olean, N. Y. The Trustees will build a sewer on Fourth street.——Atlanta, Ga. The present system of sewers is stated to be defective and a complete and efficient sewerage system is advocated.

On the Best Manner of Making Use of the Services of Experts in the Conduct of Judicial Inquiries.

By Clemens Herschel, C. E.

"*Periti potius judices sunt quam testes*" A common expression with law writers of the Middle Ages.

"*Et generaliter unicuique in arte sua experto credendum est.*"

Durantis, A. D. 1237-1296.

(*Concluded from page 235.*)

Following the establishment of the German Empire, after the Franco-Prussian war of 1870, the new empire enacted several codes of procedure. These treat, of course, incidentally of the methods of making use of experts (*Sachverständige*, literally translated, understanding the thing). There is also a late monograph on the subject in the German language, said to be the best there is on the subject, the title of which I translate as follows: "A Treatise upon Experts, as they appear in Civil Cases, following the Common Law, and the later Statutes, more especially the Code for Procedure in Civil Cases of the German Empire, by Moritz Obermeyer; a Prize Essay of the Law School at Munich; Munich, 1880, 209 pp." Needless to say that this work treats the subject with the exhaustiveness to be expected nowadays in German treatises. I will not enter upon a statement of its contents. To give a brief synopsis would be a mutilation, and to attempt anything more would result in another treatise, which could find no room within the pages of the present essay. Nor does it properly belong to me to do this work. I hope, however, that the attention of our lawyers, once called to this book, its influence may be felt in the good work which it is the object of this essay to advocate.

For the purppse of conveying some insight into a code of procedure which recognizes and makes use of the court or judical expert, I have translated most of the articles from the Codes of Procedure in Civil and in Criminal Cases for the German Empire, that relate to experts, with such slight comment as may seem of special interest at the present time, and give them in an appendix.*

The Continental practice does not exclude expert witnesses called by the parties, being expert witnesses very much as they are known to us. On the contrary, they become an absolute necessity in certain contingencies. See, for example, § 379 of the code above translated, and as given in the appendix. In the book of Obermeyer, p. 52, the best and most widely accepted doctrine on these points is said to have been enunciated by Mittermaier, as follows: "Parties must provide proof by experts of facts which cannot be appreciated (felt) by the action of the senses of persons devoid of expert knowledge, but the court should call in experts as its helpmeets (*instructores, informatores judicis*), in case it be unable, after having heard the evidence, to answer certain preliminary questions, the answering of which is, however, necessary to the exercise of its judgment in the endeavor to arrive at the final decision." And it would appear, from the few indications of the actual practice in Germany which I have been able to obtain, that the expert called by the parties is a common enough figure in the German courts; but unlike our present practice, he ordinarily finds himself confronted, listened to, and judged by certain *informatores judicis*, who know very well what he is talking about, what opinion of his they should give weight to, and what they may allow to influence them but slightly. They know also, and without difficulty recognize, the mountebank or the charlatan in his profession, by his acts or by his testimony, and are not readily led astray on side issues, or blinded by a display of matter irrelevant to the main issue.

Again, it is not true, as is so generally claimed in magazine literature (in the "Popular Science Monthly," March, 1885, for instance), that on the Continent the opinion of the expert is binding on the court; and on this account their systems "are contrary to the spirit and genius of our institutions": a cant phrase, which seems to be copied back and forth, and apparently without other foundation or prime moving cause than an extremely superficial knowledge—an incorrect one at that—of the Continental practice. I do not find it to be the case by law, anywhere, that the opinion of the expert may encroach on the functions of the court, whatever the result attained, due to placing the expert in a more responsible and trustworthy position, may be. Obermeyer's book teaches this doctrine throughout, and all the codes I have seen, or seen quoted, so provide. For instance, Art. 323 of the Code de proc.: "*Les juges ne sont point astreints à suivre l'avis des experts, si leur conviction s'y oppose.*" Note the use of the word "*point*" instead of "*pas.*" (The judges are in no way [or by no means] constrained to follow the judgment of the experts, should their convictions be thereto opposed.) See also Art. 377 of the Code for the German Empire. A mere judgment, that the expert opinion rendered is "insufficient" or unsatisfactory, enables the court to order a new one, from the same or from other experts; and, it will be noticed, that throughout the court keeps the whole matter of experts well in hand. Indeed, it may safely be assumed, and my own experience certainly would lead me to assert, that mankind is never so different in its judgments of what is meet and proper as certain superficial observers would fain have us believe.

This seems to be especially true in matters of law; as it must be, when we consider that the administration of justice can belong to no one race or clime; and though, as a whole, no foreign code, or part of a code, could be transplanted and made to assimilate, as it stands, with "the spirit and genius of our institutions," yet the underlying principles of every just code are worthy of close study and are capable of adoption, in part or as a whole, wherever and whenever all possible approach to perfection shall be the object sought. In connection with matters of this sort, it must be remembered that it is very diffi-

*The French law of experts, and the practice under it are exhaustively treated in *Traité théorique et pratique des Expertises*, etc. *Oscar Dejean, ancien magistrat.* Second edition, Paris, 1881, 659 pp.

cult to get certain classes of information regarding foreign countries, correctly. To illustrate from the subject under discussion,—I am conscious of knowing almost nothing as to the actual working of the system of making use of the services of experts in judicial inquiries, here advocated, and notwithstanding such systems have long existed elsewhere, are described in codes of procedure, as also in treatises upon them. A full, practical, and available knowledge could come only from intelligent observation and experience on the spot, in addition to a study of the subject; and the conjunction of favorable circumstances that would convey the results of such observations to us is surely a pearl of rare growth. If one will consider whence comes to us information of the serious sides of foreign life, he will soon recognize, that ordinarily what little we see or hear thereof comes through the channels of young men studying abroad, or else of travelers for pleasure; and will weigh at its just value a judgment based on recollections of a piece of gossip, retailed during the years when the writer studied abroad, or on other such haphazard information; and he will regret the lack of reliable testimony upon the facts in hearing.

To treat of still another point which seems to have been popularly misunderstood, I refer to the process which has been said to compel experts to serve in Continental countries, under such fees only as may be due the ordinary witnesses. I find the same arguments brought against such a proposition or the coercion of an expert (an impossibility, in point of fact), in Obermeyer's book, as may be read in the "North American Review" for June, 1884, and elsewhere in our magazines. It is, indeed, made the duty of experts to act when called upon (see Arts. 373 and 374 of the Code for the German Empire), but the sum of the two possible consecutive fines is only $225. The expert's fee in term time, law of 1875, was not over fifty cents for every hour or fraction of an hour, equivalent to about a dollar an hour, reckoning value of money as with us; and there can be no other punishment for a gross and inexcusable neglect to serve. On the other hand, "the court may" (for reasons good and sufficient unto itself) "relieve an expert from the duty of giving his expert opinion." Of course, I do not know, and I find no evidence in their writings that the objectors, above named, do know, the amount, if any, of actual hardship to experts under the German or French Code. I doubt if there be any. Note, as to fees, Art. 378, translated in the appendix. I have not the law of June 30, 1878, "fixing the fees for witnesses and for experts," but have the law of July 1, 1875, which the former seems to have replaced. I find in it nothing that an American expert would, in my opinion, consider a hardship; taking account, of course of the different value of coin or money in the two countries. He is allowed not exceeding fifty cents an hour for his services in the court-room, limited to a charge of ten hours per day. But note Art. 3, which I translate as follows: "On request of the expert, he is to be allowed, in addition to the fees just named for services in term time, payment at a rate as fixed by the customary prices for such services, for the investigation and the rendering of the expert opinion with which he has been charged."

To resume, then: we find, in well-informed circles, a general dissatisfaction with our present method of making use of the services of experts in judicial inquiries.*

This has found expressions in the writings and sayings of our judges, law-writers, lawyers, the jury, and the experts themselves. The only remedy suggested, and that one suggested quite frequently, is to call in judicial experts alone, or along with such experts as the parties may choose to call; the judicial experts to be the servants of the court (*Informatores judicis*). Such was the old English practice, such is the Continental practice at the present day. The objections commonly put forward with us, in current literature, against certain features of the Continental practice, do not seem to be founded in fact, nor on any theoretical study, or yet observation of the actual working of the system, worthy of the name. We find, on the contrary, that the old English practice was in fair train to lead directly up to something like the methods now unanimously advocated and looked forward to, and that the underlying principles of such a form of procedure and of the existing Continental practice, are and from the nature of things must be, one and the same, enduring and forever. I do not think it wise for me to attempt to outline the precise language of legislation, calculated to introduce benign principles of this sort into our forms of procedure. The thing to be attained, it seems to me, is to put it within the power of either party, or of the presiding justice,—possibly of the jury,—to call in one expert, or several, to act as servants of the court; to provide for the pay of such experts, and to prescribe the method in which their report may be rendered. I have been encouraged to say what I have said, by kind friends in the profession of the law, and by the report of the special committee of the Bar Association of the City of Boston, of Jan. 3, 1885. Says the committee in its recommendation: "Also, that said committee cause information to be given through the public press or otherwise, that it at all times invites formulated suggestions in writing as to changes in the law, which suggestions may be made and directed to the Secretary of the Association, and indorsed 'For the Committee on the Amendment of the Law.'"*

Action upon this report has not been taken as I write, but, upon the principle of doing a thing when one may and can, I have gone ahead at such times as have been at my command, and in the spirit above sought to be invoked by the committee of the Bar Association of the City of Boston, I respectfully dedicate and submit to the Association this plea for a change, only too long delayed, in the important matter herein considered. And I venture to express the earnest hope that the Association will put among the first of the benefits which it may confer upon society and upon its fellow-citizens a wise reform of the method of making use of the services of experts in the conduct of judicial inquiries.

Code of Procedure in Civil Cases in the German Empire.

CHAPTER VIII.

PROOF BY MEANS OF EXPERTS.

367. The regulations governing proof by means of witnesses find a corresponding application to the mode of proof by means of experts, in so far as they are not modified by the enactments of the paragraphs which follow.

1. *Framing the issues.*

368. The preparation for proof (framing the issues) consists of the determination of the points upon which an expert opinion is to be asked.

369. The court having jurisdiction is charged with the selection of the experts, and the determination of the number of experts to be consulted.

It may appoint a single expert.

It may appoint other experts to take the place of those first appointed.

Experts officially appointed to give expert opinions on certain subjects are to have preference in the trial of cases which concern those subjects, unless special circumstances should require the appointment of other persons. The court may request the parties to name persons suitable for appointment as experts.

In case the parties agree upon the appointment of certain persons as experts, the court is to comply with such agreement, but the court may confine the parties to the selection of a given number of experts.*

VII.—135. The court may of its own motion order a view, or the rendering of an expert opinion, at any time during the course of a hearing.

VII.—146.—The report of the experts must form part of the record.

VII.—337. The court may direct the presence of one or more experts at any view. It may appoint such, or authorize another tribunal to appoint them.

VII.—417. A view, testimony of witnesses and opinions of experts, may be ordered if it be feared that the means of proof are in danger of being lost or of becoming more difficult of access.

VII.—597. Experts appear under the same regulations as above, in cases for the appointment of a guardian.

VII.—593. No person may have a guardian appointed over him, without the opinion first rendered of one or more experts as to his mental condition.

VII.—861. Arbitrators may hear only such experts as voluntarily appear before them. They are not authorized to administer the oath to an expert (or to a witness).**

2. *Taking of proof.*

370. The court of jurisdiction may authorize the single justice charged with the taking of proof (trial of the case) to appoint the experts.

He is to exercise, in that event, the duties of the court of jurisdiction as defined in the preceding paragraph.

3. *Challenging of experts.*

371. An expert may be challenged on the same grounds as those which would disqualify a judge. But it can form no reason for a challenge that the expert has been heard as a witness. The challenge is to be made before the court or single justice charged with the appointment of the expert, before the expert has been heard; and in the event of a written expert opinion, before the opinion has been filed. A challenge made after this period is only permissible in case it be shown worthy of belief that the challenge could not sooner have been made. A challenge may be filed with the clerk of the court and made part of the record.

The reasons for a challenge are to be shown worthy of belief; proof on oath is excluded from the means of such showing.

The decision on the challenge is rendered by the court or single justice defined in the second paragraph; a preliminary hearing of the parties in interest is not necessary.

There is no appeal from a decision declaring a challenge well founded: an appeal may at once be taken from a decision declaring the challenge invalid.†

DECLINING TO SERVE AS AN EXPERT.

372. He who has been selected as an expert must comply with such selection, if he be officially appointed to give expert opinions of the kind demanded: or, if he exercise the science, the art, or the trade for pay in public, a knowledge of which is necessary for the formation of the expert opinion, or if he be publicly engaged or appointed to exercise such science, art, or trade.

He also is obliged to serve as an expert who has declared his readiness so to serve before a court of justice.

373. The same reasons that would authorize a witness to refuse to testify as such, will authorize an expert to decline to give his expert opinion. The court may also, for other reasons, relieve an expert from the duty of giving his expert opinions.

Employés in the public service cannot be heard as experts, in case of the declaration of the superior officer of such employé that such service would be detrimental to the public interests.

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* An objection, becoming more serious from year to year, is the length of time neces-arily occupied by the experts at each trial in teaching a new set of non-experts the simple, primary principles and terms of the expert's art, so as to render the none-expert tribunal, or in the hope and intent that it may render it, capable of understanding the evidence or opinion about to be given. Anywhere from a half to nine-tenths of the whole time occupied is thus frittered away; all of which must, of course, be gone through with again at the very next trial of a case, even though it involve a knowledge or some knowledge of the same art. In the laudable attempt to make intelligible such condensed teaching, which would accomplish the ordinary work of months in an equal number of hours, some curious scenes occasionally come to pass. I quote from the Boston "Daily Advertiser," of March 27, 1885.

"REAL EVIDENCE IN COURT YESTERDAY.

"During the trial of an action yesterday in the Superior Court, to recover damages for personal injuries, the court-room was for a short time turned into a clinical lecture-room. The plaintiff, whose collar-bone had been dislocated by the derailment of a railroad car in which he was riding, presented himself for inspection by the jury, and his attending physician pointed out to the court and to the medical experts the exact nature of his injuries. This was in itself a curious piece of real evidence. It was supplemented by the production of very grim 'chalk' in the shape of a mounted skeleton. The presence of this uncanny object within the rails of the clerk's desk caused considerable consternation to the chance spectator who dropped into the court-room, unaware of the nature of the proceedings, and doubtless suggested to many that some person affected by the warm air of the court-room had adopted SYDNEY SMITH'S proposed method of keeping cool by 'sitting in his bones.' A very irreverent member of the bar even went so far as to remark that the new assistant clerk looked very thin and hungry."

It seems to me that, however curious or funny such an exhibition may have been, it was not one to be proud of, though natural enough in the development of opinion evidence. Of course, the opinion of a judicial expert would have to be couched in terms comprehensible to any man of ordinary intelligence; but to do this would be a very different task, and one requiring much less time, than the task of enlightening the court, jury, and all the counsel upon the special art or subject, out of the mouths of many witnesses speaking in answer to questions propounded by counsel, who ordinarily cannot weigh the evidence of the expert witness, and not infrequently do not understand him as he speaks.

* Extract from a private letter: "I am heartily glad that you intimate a purpose of exploring this subject and of writing something about it. The lawyers are too busy to attend to it, and so are the judges. And as to our legislation, every one knows how that goes forward."

*According to VII.—3, the court may of its own motion appoint experts for determining the value of things in dispute.

**One method of selection sometimes followed, I believe, is for the court to present to the parties the names of more experts than are required, and then to permit the parties to exercise, each, a definite number of challenges; thus: in order to select three experts, let seven names be presented, and give to each party the right of peremptorily challenging two of them.

†In criminal cases (Art. 74 of the Criminal Code,) "the right of challenge may be exercised by the public prosecutor, the complainant, or the accused." Unless especial circumstances should interfere, the parties having the right of challenge are to be served with a notice, giving the names of the experts appointed.

CONSEQUENCES OF A NEGLECT OR REFUSAL TO APPEAR.

374. An expert charged with the rendering of an expert opinion, who shall neglect or decline to appear, is liable to a fine not exceeding three hundred marks ($75) and costs of court.

On a repetition of the offence, he is liable to a fine not exceeding six hundred marks ($150).

From such penalty he may appeal.

The determination and execution of the penalty, in the case of persons in active service in the army or navy, are to be exercised, on petition, by a military court.

SWEARING OF EXPERTS.

375. Unless both parties waive his taking the oath, the expert is to be sworn before rendering his expert opinion, as follows: That he will render the expert opinion asked of him impartially and according to his best knowledge and conscience (belief). In case of experts already sworn publicly to the rendering of opinions of the kind in hearing, a reference to the oath already taken is sufficient.

376. In case of a demand for a written expert opinion, the expert must file his opinion, signed by him, with the clerk of court.

The court may order the appearance of the expert for the purpose of explaining his written opinion.

377. The court may order a new expert opinion from the same or from other experts, if it consider the opinion rendered insufficient.

The court may order an expert opinion from other experts, when an expert has been effectually challenged after rendering his opinion.*

FEES.

378. An expert has claim for compensation according to enactment of law for time spent, for repayment of costs, and also for a proper compensation for pains taken by him.†

EXPERT WITNESSES.

379. In so far as experts must be heard, for proof of acts or circumstances that have gone by, and for the verification (appreciation) of which an especial expert knowledge was requisite, the same regulations apply as those governing the taking of the testimony of witnesses.

SOME PROVISIONS OF THE CRIMINAL CODE SPECIAL TO IT AS COMPARED WITH THE CODE FOR PROCEDURE IN CIVIL CASES.

80. On request of the expert, and for purposes of preparation for the rendering of his opinion, he may be furnished with additional information by means of a hearing of witnesses or of the accused.

He may also, for the same purpose, be allowed to inspect the records of the case, to be present at the hearing of the witnesses or of the accused, and to question the same directly.

6. *Expert opinion on the mental condition (sanity) of the accused.*

81. The court may, upon motion of an expert, and after hearing the defendant counsel, for purposes of preparation for an expert opinion as to the sanity of the accused, order the same to be placed and watched (observed) in a public asylum for the insane.

Counsel is to be furnished to accused (defendants) who have none.

From such order there may be an immediate appeal. Pending appeal the order is suspended.

The period of detention in the said asylum is not to exceed six weeks.

82. In preliminary examinations, it is for the justice to say whether the experts shall give their opinion verbally or in writing.

91. If there be suspicion of poisoning, the examination of the substances found in the body or elsewhere is to be made by a chemist, or by a professional corps organized for that purpose.

The court may direct that this examination be made with the aid, or under the direction, of a physician.

EXPERT OPINIONS IN CASES OF CRIMES AGAINST THE COINAGE.

92. In case of crimes and misdemeanors concerning coinage, the coin and papers are to be laid before the officials charged with utterance of the genuine coins and papers of the kind in point. The expert opinion of these officials is to be obtained, both as to genuineness or counterfeiting, and as to the probable method followed in counterfeiting.

In the case of foreign coins and papers, the expert opinion of a German official may be asked, instead of that of the designated foreign officials.

COMPARISONS OF HANDWRITING.

93. For purposes of determining the genuineness of the forgery of written documents, and for the purpose of discovering the forger, a comparison of handwritings may be gone into, with the aid of an expert.*

191. . . . The public prosecutor, the accused, and his counsel have the right to be present at the hearing of those witnesses or experts who are not expected to be present at the trial, or who may be prevented from appearing by residing at a considerable distance. . . difficult of procurement, by reason of very distant residence.

THE TRIAL (PRINCIPAL PROCEEDINGS).

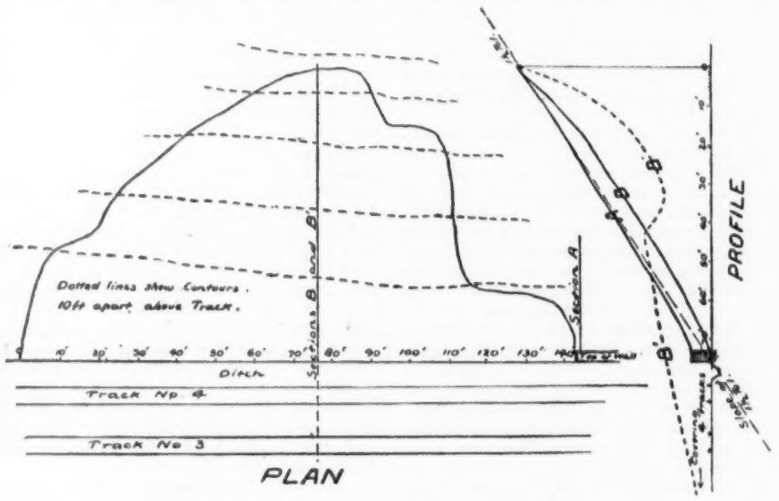
5. "*Cross-hearing.*"

238. On joint motion of the public prosecutor and of counsel for the accused, the presiding justice is to leave the hearing of the witnesses and of the experts summoned by these two, to them. Each one has the right to the direct examination of the witnesses and the experts summoned by him.

The presiding justice is to question the witnesses and the expert as seems to him proper, after the hearing (examination) as above described.

239. On request, the presiding justice is to permit the other justices to address questions to the witnesses and to the experts.

The presiding justice is to grant this privilege also to the public prosecutor, to the accused, to his counsel, and to the jury and "side-justices."



Landslide on N. Y. C. & H. R. R. R.: Plan and Profile.

PREPARATION FOR THE TRIAL (INCLUDING PRELIMINARY HEARINGS).

218. If the accused request the summoning of witnesses or of experts, or the procural of other means of proof for the trial, he must move the presiding justice of the court to that effect, stating the facts which it is intended to prove. The decree thereupon issued is to be communicated to him.

Motions for proof made by the accused and granted are to be communicated to the public prosecutor.

219. If the presiding justice decline to grant the motion for summoning a certain person, the accused may summon said person directly.

He may do this, furthermore, without first moving as above defined.

Persons thus summoned directly are obliged to appear only on tender, at time of the summons, of the lawful fees for travel and time spent, or on deposit of the same with the clerk of the court.

Should it appear at the trial that the testimony or expert opinion of a person summoned directly had been of service in the elucidation of the case, the court is to decree, on motion, that the lawful fees be paid to said person from the state treasury.

220. The presiding justice may decree the summoning of witnesses and of experts, and the procural of other means of proof, without motion.

221. The accused must, betimes, name to the public prosecutor the witnesses and experts summoned by him directly (to preliminary hearing) or to be present at the trial, as also their respective places of residence.

The public prosecutor has the same obligations as those just named towards the accused, if he summon persons other than the witnesses or experts named in the indictment, or summoned on motion of the accused, by decree of the presiding justice, or on his own motion.

4. *Hearing of witnesses or of experts before a commissioner.*

222. If disease, disability, or other irremovable difficulties prevent the appearance of a witness or of an expert at the trial for a long or an indefinite time, the court may decree such hearing to take place before an authorized or asked for justice. Such hearing is to be conducted under oath, to the extent to which such procedure is permissible.

The same rule holds good if a witness or an expert is to be heard whose appearance may be especially

241. The court decides in all cases of doubt as to the admissibility of a question.

BOOK IV.

REOPENING OF A CASE ONCE CLOSED BY LAWFUL JUDGMENT.

1. *Reopening in favor of the condemned.*

399. A case once closed by lawful judgment may be reopened in favor of the condemned, . . in case the witness or the expert was guilty of a negligence or willful contravention of his duties under his oath, in swearing to a piece of testimony or to an expert opinion delivered in disfavor of the condemned,

2. *Reopening against the interests of the accused.*

402. A case once closed by lawful judgment may be reopened in disfavor of the accused, . . . in case the witness or the expert was guilty of a negligence or willful contravention of his duties under his oath, in swearing to a piece of testimony or to an expert opinion delivered in favor of the accused.

Landslide on the New York, Central & Hudson River Railroad.

The landslide occurred during the evening of Monday last, April 18, at a point two miles west of St. Johnsville, N. Y., where the road-bed was bordered on one side by the Mohawk river and on the other by a hill, profiles of which are given. The slide covered the four tracks for a length of about 150 ft., to a depth of from 2 to 8 ft. A heavy east-bound passenger train on track No. 1, next to the river, struck the slide. The engine made its way entirely across the obstruction, plunged down the embankment and lies on its left side with its smoke-stack in the water. The tender was turned completely over and lies on its right side.

A broken coupling saved the cars from following the engine down the embankment. Several of them were derailed and thrown across the tracks. One passenger was slightly injured, the engineer was killed and the fireman was severely, perhaps fatally, injured.

The hill is composed of a clay sub-stratum to a height of about 12 ft. above the level of the tracks.

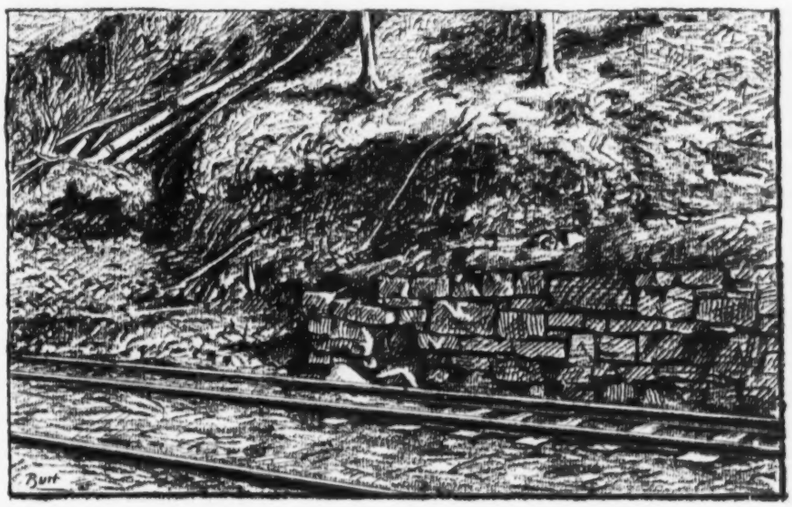
* The Crim nal Code Art. 83, has in addition: "the expert opinion of a professional corps" (which I take to mean faculty of a university, society of men practising a profession, trades union, etc.) "may be obtained in important cases." There seem to be many such bodies of experts, who give a concerted or single opinion, in ordinary use. Such have been formed, apparently, for conducting chemical and pathological examinations, and for making expert reports in poisoning cases, as will presently appear. By the laws of the German Empire, of June 11, 1870, Art. 39; Jan. 9, 10, 11, 1876, Arts. 16, 9, and 14, respectively; and of May 25, 1877, Art. 18 bodies of experts are formed of literary and musical authorities, to give expert opinions on the damages or benefits caused by a contravention of the copyright laws. This system has also been extended to cases involving questions of copyright on patterns, trademarks, etc.; and in some way to patents generally, the last cited law being a patent law. I have not seen the legislation quoted, and speak from the best information at date attainable.

† Art. 166 of the G. V. G. gives him the right to demand partial payment in advance, in case of his residence some distance from court. I have discussed this matter of payment of the expert, and extent of compulsory service by him, in the text.

*To which i added the note, in my edition, "or without such aid."

and about 60 or 70 ft. of gravel. A large amount of water is draining out of the hill, most of it appearing to come from the top of the stratum of clay. (We estimated between 2 and 3 cu. ft. per second flowing from the part of the hill affected by the slide). The hill is of the same constitution for about 600 ft. to the west, beyond which it seems to to be dry. To the east it is of similar constitution for perhaps 1000 ft. Beginning at the east end of the slide the hill is protected by a retaining wall about 5 ft. high for about 850 ft. *beyond* the slide. The slide injured about 6 ft. of the end of the wall.

The profile of the hill at the end of the wall is marked *A* in the cut. Trustworthy evidence shows that the portion of the hill not protected by the retaining wall has slid down into the ditch to a greater or less extent for a number of years. This consideration, together with a comparison with a similar place just west, would indicate that the profile of the hill at the center of the slide, before the slide



Landslide on N. Y. C. & H. R. R. R.: General View, from Photograph.

took place, should be about as shown in profile *B*[1]. The profile at the same place, after the slide took place would be about as indicated in profile B. The tracks were cleared before this examination took place. The gravel super-stratum appears to have slid bodily upon the clay sub-stratum which was thoroughly wet, some clay being carried with it. The trees at the upper side of the slide were carried down standing upright, as indicated by the stumps in the photographic view. Those lower down, and carried upon the track, were most of them overturned. The trees were all small. The slide began at a point about 20 ft. below the top of the hill.

Large cracks appear in the hill for 75 ft. west of the slide. A slide at this place is probably prevented by larger trees more firmly rooted, and a somewhat gentler slope near the base of the hill. Farther west, slight slips were noticed tending to fill up the ditches, the largest being that of a mass about 30 ft. square, which had moved out bodily 2 or 3 ft. into the ditch. It seems that the retaining-wall should have been continued at least 200 ft. farther west and that such a construction would have prevented the slide. The view shown was taken at the point *A* on the plan, with the camera standing on track No. 2. It shows very clearly the part that the wall had in checking the sliding tendency.

Prof. CHARLES C. BROWN, of Union College, Schenectady, N. Y., was kind enough to very promptly investigate this matter for this journal, and caused to be taken for us some further views which we regret it was impossible to present in this issue in the very brief time available.

Lawrence, Mass.—The report of the State Board of Health that the Merrimac river water was very impure and fast approaching a point where its use would be dangerous, has caused considerable alarm among consumers, and there is a strong feeling in favor of some means of purification. It is considered in some quarters that a sewer will be a necessity along the river bank from Lowell to below Lawrence to preserve the purity of the Merrimac water.

PUBLICATIONS RECEIVED.

Annual Report of the City Engineer of the City of Omaha, Neb. Mr. ANDREW ROSEWATER, in submitting his sixth and concluding report of public works for the period ending Jan. 1, 1887, states that in rendering an account of his services as engineer in charge of public works of the city for an aggregate period of over ten years he considers it his duty to place before the Council and his successor an outline of the early and recent improvements with the causes for their adoption. Omaha was laid out as a town site in 1854. The topography, grades, park, water-works, sewerage (including the separate system and combination sewers), paving, viaducts, garbage disposal and cement and sand tests are all described. Tables are given showing the work done in 1886, and an appendix contains interesting information relating to the original survey. The report is accompanied by illustrations of the topography of Hanscom Park, the water works reservoir, sewers, flush tanks, manholes, catch basins, viaducts, dump boat and a plat showing method of special taxation. There are also four large city maps showing the locations of hydrants, the street paving, the grading and the sewerage.

Quarterly Report of the Chief of Bureau of Statistics relative to Imports, Exports, Immigration and Navigation. Washington, D. C.

This issue is especially interesting in its full and carefully presented statistics of the fisheries and liquor consumption. Those interested in either of those questions will gain much light from it. The immigration statistics indicate that we are just approaching an era of immense immigration.

Annual Report of the State Geological Survey of New Jersey for 1886. This is another one of the excellent reports of Mr. GEO. H. COOK upon the geographic and geological surveys and the economic geology of New Jersey; a more extended notice will be given later.

The Baltimore & Ohio Apprentices.

The Board of Directors of the Baltimore & Ohio R. R. Co., at their last monthly meeting, voted the technological school at Mt. Clare $25,000 cash and an endowment of $20,000 per annum.

This school was instituted in 1880 on the broad principle that business and philanthropy can go hand in hand, and that the welfare of a corporation depended greatly upon the prosperity and content of its employés and the ability of the latter to earn a livlihood. With this end in view, an accident and sick and death relief association was formed, a home established for disabled and aged employés, a summer health resort selected for their families, and finally a well equipped school was founded for the sons of employés at the Mt. Clare works.

This school has an accomplished corps of teachers, is open in day and evening, and technical and physical instruction is given to the company's apprentices. The late action of the directors is intended to enlarge the scope of this school by establishing on permanent basis a railroad school of technology. Prest. GARRETT stated its purpose as providing a source from whence could be drawn intelligent and yet experienced material for the minor positions of responsibility and trust on the railroad, and indeed for the higher positions as the young man might develop. He thought this end was best attained by a prolonged combination of class-room and shop instruction, such as was now being carried out by Dr. BARNARD at Mt. Clare. He believed that the investment of $20,000 per annum would return to the company a more direct and greater value than in the case of the relief association.

In connection with this association Mr. GARRETT stated that since its institution in 1880, $1,331,515.10 had been disbursed to its members for sick, accident and death benefits; that its savings bank holds $598,744.30 of the employés money, and of this $363,108.91 had been loaned to other employés to build homes along the company's lines. It has $323,788 invested in the company's securities which it holds to meet outstanding liabilities, against the aging of members and for expenses not precisely current, besides the sum of $138,175.10, which is equal to what has been paid from the treasury towards its support since 1880, and which has been set aside as a permanent fund for pensioning old employés as they become incapacitated from giving the company a full equivalent in work for their wages. That fund is now supporting nearly 150 such employés, who, from humanitarian, no less than for practical reasons, could not otherwise have been discharged, and who, unfit for duty as they were, would have absorbed in yearly wages more than all that is advanced by the relief association. Other employés are added to this list from time to time as their retention in active service is found to be uneconomical.

The Foundations for the 1000-ft. Paris Tower.

According to *Le Genié Civil* work upon the foundation of the 1000 ft. Eiffel Tower in the Champ de Mars, Paris, is being vigorously pushed. Careful soundings on the site show 46 ft. to the surface of the clay stratum underlying the Paris basin. This clay is dry and compact and presents a very good foundation for the work, but the material lying between it and the surface of the Champ de Mars is for about half its upper depth an alluvial deposit and rubbish of no general geological characteristic, and the lower half is sand and gravel. It is proposed to sink at each of the four corners of the tower masses of masonry about 50 ft. square and developing a reaction, or resistance to lifting, of 3,000 French tons, and to load the soil with not more than 3.7 tons to the square foot.

At the two piers most distant from the Seine the depth to the sand and gravel stratum is about 25 ft.; at the top of this stratum and under each of the four corners of the general mass will be sunk four wells, each 13 x 33 ft., filled with beton and extending some distance down into this material. At the other two piers, the bed of resisting sand and gravel is met at 36 ft. below the surface and for these foundations caissons and compressed air are to be used. These caissons are made of iron, and are each about 50 x 20 ft. in surface dimensions with a working chamber 6½ ft. high and roof-beams 23½ in. deep; when sunk to the clay they are to be filled with beton and then beton piled upon them to the level of the Seine, or 26 ft. below the general surface.

Upon these sixteen foundation masses will rest four pyramids of masonry, each 26.24 ft. high, with their axes corresponding with the line of inclination of the four built corner posts of the tower. Each pyramid will be surmounted by two heavy courses of cut stone on which will be secured the great cast-iron shoes of the metal tower. In the interior of each pyramid will be the double anchor bolts—each 6-in. diameter—fastened in the masonry at their lower ends to double I-beams 7¾ in deep.

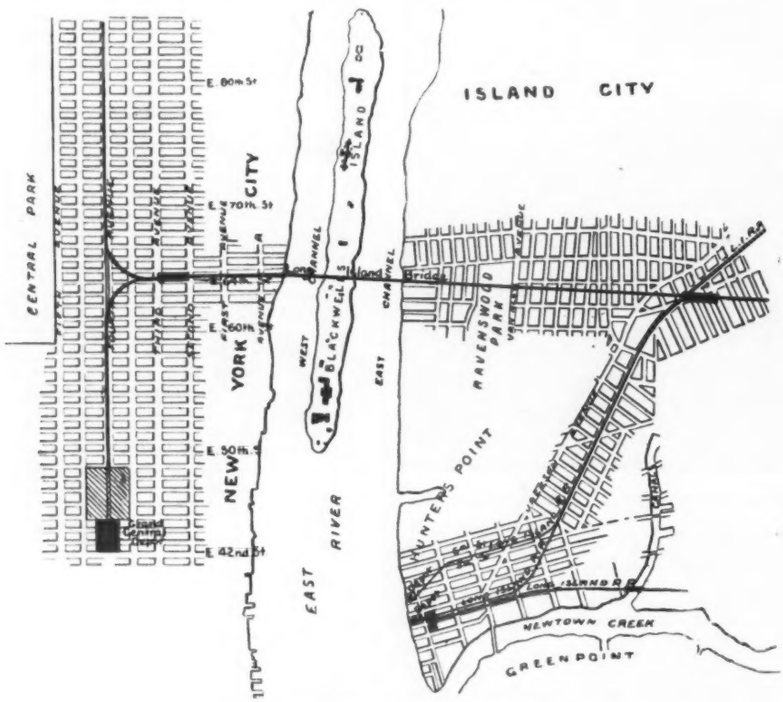
CUTTING GLASS TUBES.—The following is given in the *Franklin Institute Journal*, as a sure method of cutting glass tubes of any thickness and diameter, as well as funnels, bell-jars, etc. These may be safely cut by making a file-mark and then building up rings of wet filter paper, 1-2 mm. high, and 2-4 mm. wide on each side of the mark, at a distance of 1-2 mm. The intervening space is then heated in a Bunsen burner flame, or better, by the pointed flame of a blast-lamp, while the tube is rotated on its axis. The tube then separates at once in the line between the walls of filter paper. The paper must be saturated with water, must be evenly laid on, so that it builds up straight walls, and the thickness to which it is wrapped will depend upon the diameter and thickness of the tube.

The Proposed Long Island Bridge.

The bridge will cross the East river between 64th and 65th streets, where the river is divided by Blackwell's Island into two channels of about 860 ft. each.

The site was selected not only on account of its advantages, as being particularly well adapted for the construction of a bridge, but also because it is the location where a bridge at present is mostly needed, facilitating the best connection between the railroad systems of New York and Long Island. The bridge consists of two spans, each of 810 ft. clear, across the east and west channels of the East river, one span over Blackwell's Island, and iron viaducts forming the approaches in New York and on Long Island. The New York approaches terminate, one at the Grand Central Depot, 49th street and 4th avenue, the other at 79th street and 4th avenue in the Harlem Railroad Tunnel.

The Eastern approach terminates in Long Island City 6,000 ft. east of the East river; and there will be



Site of the Proposed Long Island Bridge.

from this point a continuation of the approach by a double track of nearly one mile to the city line. There will be a depot 102 ft. wide between 2nd and 3rd avenues, New York, with elevators for passengers and freight, and two stations at Long Island City; one at the city line, and one at a point 6,000 ft. from the river.

It is proposed from this latter point to build a double track railroad into Brooklyn, passing near the great manufactories and water front to the Navy Yard, and thence as direct as possible to the City Hall.

The bridge is designed for railway, passenger and freight service alone; carriages, trucks, market wagons and funeral trains will be transported on closed platform cars, which enter between raised platforms, where they can be driven on or off in a few minutes. There will be elevators on each side of the river. The whole structure will be lighted by electricity.

The river spans of which we give an illustration, and some details on page 267 consist of two cantilever bridges of 810 ft. in the clear, 1,290 ft. long over all, resting on braced steel towers 110 ft. high. The towers are supported by substantial masonry piers, which are founded on the solid rock. The shore ends of the cantilevers are anchored to masonry piers, the river ends being connected by an intermediate span of 270 ft.

In order to provide for free expansion and contraction of the metal, and to eliminate temperature strains, the shore ends of the cantilevers have rockers attached to their anchorage connections, and the intermediate spans are provided with slip joints where they connect to the river ends of the cantilevers. The trusses are spaced 40 ft. between centers and over 108 ft. deep over towers.

The compression members, such as lower chords, posts, etc., will be formed of plates and angles, the tension members will consist of eye-bars 8 in. to 10 in. wide. The various members composing the trusses will be connected at their points of intersection by turned steel pins 8-in. to 12-in. diameter.

The tracks and foot-walks are supported by four lines of plate girders; they will be riveted to the transverse floor-girders, at each panel point. The transverse floor-girders are connected to the vertical posts.

The track consists of oak ties, which carry the rails and planking for the footwalks. There will be iron guardrails inside and wooden guard timbers outside of each track. The footwalks will be provided with substantial iron handrailings. There will be a system of lateral bracing between the trusses in the line of the upper and lower chords, of sufficient strength to resist the greatest wind pressure which can come upon the structure.

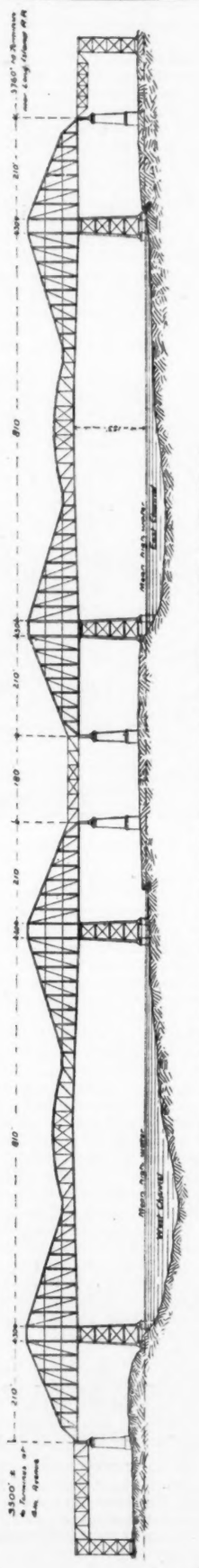
The whole of the metallic superstructure will be made of the best open hearth steel, having an ultimate strength of 60,000 to 80,000 lbs. per sq. in.

The milder steel will be selected for rivets and tension-members, the harder steel for compression members, pins and bearing plates. The structure is designed to carry in addition to its own weight, a moving load, on each track consisting of two 90-ton consolidation engines, with tenders, followed by a train of unlimited length, weighing 3,000 lbs. per lin. ft. Provision will be made for a wind pressure of 30 lbs. per sq. ft. on the exposed surface of all trusses and the floor system, plus the exposed surface of a train 10 ft. high.

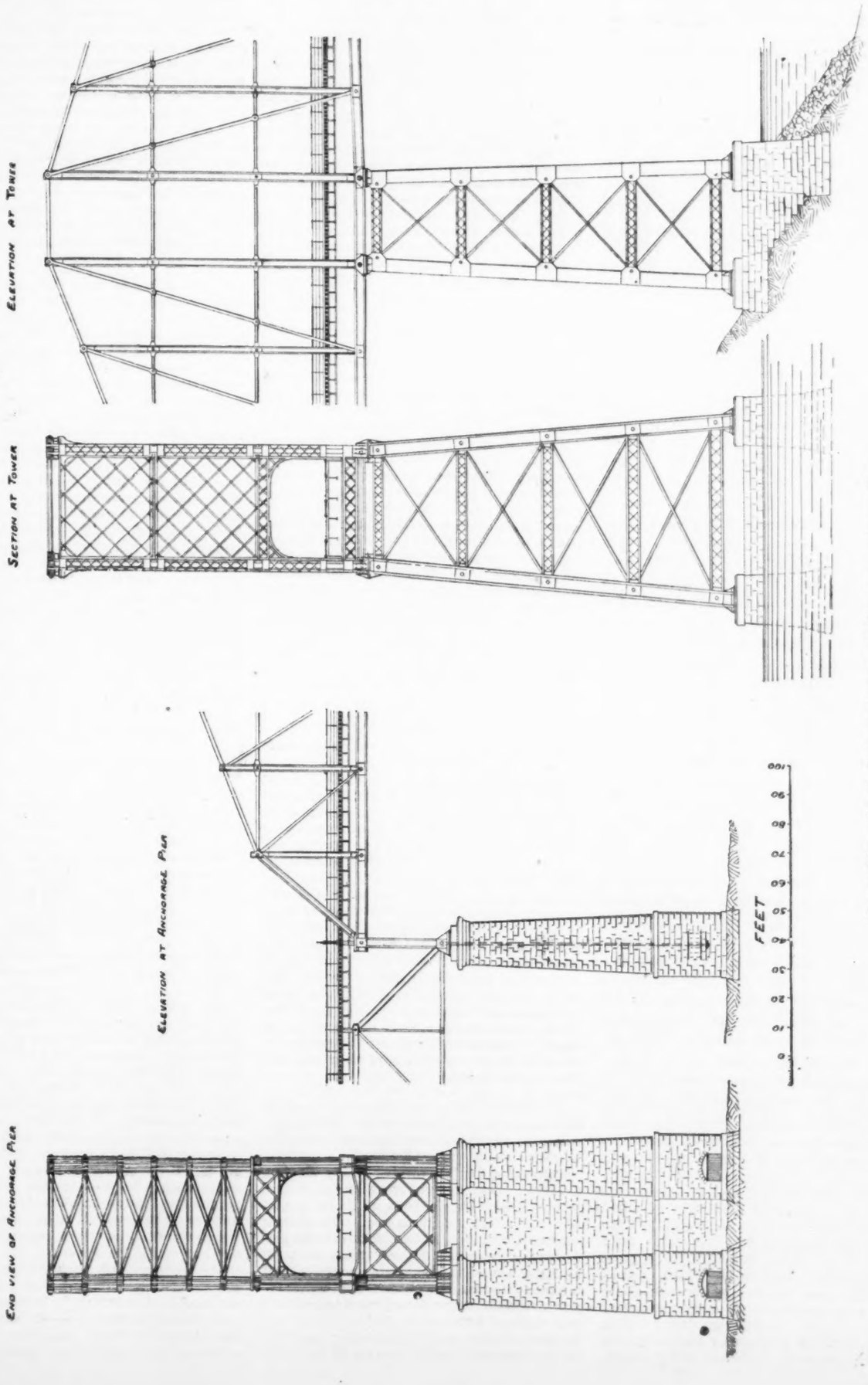
According to the engineer's estimate, the following quantities of material will be required for the construction of the bridge and its approaches:

25,000 cub. yds. of masonry; 26,000 tons of steel and wrought-iron; 9,000 tons of steel rails; 3,000,000 ft. B. M. of timber for flooring.

The bridge is designed by Mr. C. C. SCHNEIDER, the engineer of the Niagara cantilever bridge, and well illustrates the adaptability of this type of structure to the crossing of deep and much traveled rivers. The present project has been mainly worked up by Dr. THOMAS RAINEY, and we are informed that the necessary means of execution are "in sight."



General Elevation of the Proposed Long Island Bridge, over the East River and Blackwell's Island.



Proposed Long Island Bridge: Elevations of Main and Anchorage Piers.

ENGINEERING NEWS

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D. McN. STAUFFER. A. M. WELLINGTON. EDITORS.

GEO. H. FROST, - - - BUSINESS MANAGER.

Subscription. — UNITED STATES AND CANADA, $5.00 *per Year*; $2.50 *for Six Months*; $1.50 *for Three Months*; *Single Copies*, 12 *cents*. FOREIGN COUNTRIES, $6.56 *per Year*, or 3 *cents per number additional.*

Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also,* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

THE generous offer of MR. EDWARD BATES DORSEY, in another column to be one of twenty *or more* to subscribe $100 each to raise a fund toward supplying the more urgent deficiencies of the library of the American Society of Civil Engineers, is the most decided and most earnest step toward the formation of a "Union Engineering Library" which has as yet been taken. Whether or not it will result in accomplishing its end is another and quite different question. It depends upon the temper of the membership generally, and when the question involved is the giving of money it is always the safer assumption that the tendency will be not to give it; but the members have been very liberal to the Society in the past, and the result of such a subscription would be so obvious and great a good, and would be so likely to bear fruit in the future of many fold more value than the immediate sum raised, that we shall hope, so long as we have a chance to, that the response will be liberal and decisive. MR. DORSEY is not a rich man. If the membership generally should respond as generously in proportion to their means it would result in the formation of a fund of fully $30,000 or $40,000, and the far-reaching consequences of a subscription of half or a quarter of that amount to benefit the Society and the engineering profession generally can hardly be overestimated. We gladly do what we can, therefore, to call attention to this offer of MR. DORSEY, and would further remind members who may feel any hesitation in the matter that he gives twice who gives promptly, in such matters especially. Should so generous an offer fail of proper recognition, the responsibility will at least not be ours.

The circumstances are such as to make the raising of such a fund peculiarly wise and judicious. The American Society of Civil Engineers has already a fine foundation for a library, which would not only cost a great deal of money to replace, but which in good part could not be replaced by the expenditure of any sum whatever. A large amount of valuable and rare material has flowed to it in the past and will continue to flow to it, from gifts and bequests, including many manuscript records, photographs and plans, which are not to be bought with money. Nevertheless, the library as it is now is almost worthless as a reference library for the average engineer, and a very annoying one to consult by anyone, for this reason; that current engineering publications, even the short list of those of great and general value which appear every year, are not procured for it, Available funds do not exist. Therefore, while there are plenty of the rare publications which only one man in a thousand wants to see, but he wants very badly, there are next to none of those recent publications which every other man wants to see, and which are all but indispensable to make even the rare volumes practically useful. We think we are correct in stating that while a considerable sum has been expended on the library in one way and other, as must necessarily be in merely caring for a library, the sum available and used for the actual purchase of books has been so small as to amount to nothing. While we cannot but believe that this policy has been carried too far, yet it can be reasonably defended on the ground that the funds of the Society were small and that their use for "building up a local library" would provoke just criticism among outside members. Admitting, as we cheerfully do, the force of this argument, the fact yet remains that a comparatively small sum will go a long way to turn the society's accretion of books into a true library, and, as we are in a position to know peculiarly well, it will be of almost as much value in the aggregate to the non-resident membership as to those in New York. No man can tell when he will have some problem before him which will make the cost of a trip to New York cheap indeed for the professional assistance he can derive from a *real* engineering library, well cared for and well kept up. Since there cannot be such a one everywhere, it is for the interest of the whole profession that there should be one somewhere, available to all, as the Society library practically is.

Such a library *must be formed* before long, somewhere. Circumstances now demand it. It is but the turn of a hand whether the good foundation of the Society of Civil Engineers is built upon for that purpose or a start is made elsewhere. The history of all such accretions is that they start from small beginnings and grow slowly at first, and rapidly afterwards. Once it begins to show its head above its fellows, as a live and growing thing, and gifts and bequests of all kinds flow to it, as water runs down hill, especially when it is clear that it is in good hands, which take a pride and interest in it. The Public Library of Boston was started by a single gift of $50,000. The Library of the Institution of Civil Engineers grew even more slowly at first than our New York library, and it now is the finest in the world. Technical interests are the rising ones in this country. A little seed sown now may have a great result.

The Engineer in reproducing some of our illustrations of the Bussey bridge disaster and commenting thereon, and upon our account of the Woodstock wreck as well, holds up these bridges as a fearful warning to the English Colonies. Our contemporary suggests that these colonies should have as little as possible to do with American engineers or their works; and though it does acknowledge that America possesses some "most talented, highly educated and honorable engineers," it tempers this compliment with the further remark that these gentlemen rarely ever get a fair chance, but are pushed aside by less scrupulous men, and it is the latter class that the colonist will most likely have to deal with.

This advice is given with true British disinterestedness; but *The Engineer* should have studied our report of the Bussey bridge somewhat closer, and it would have seen that engineers had nothing to do with it, as the bridge was neither designed by an engineer, nor did the railroad company have an engineer to care for it after erection. American engineers can not be properly held responsible for such work; and we must agree with our contemporary in the statement that this was one of the cases where the "economy" of a rich corporation prevented the engineer from having a "fair chance." The "nearness" of the corporation and not the engineering profession, must be charged with this, and similar abortive bridge designs, and the too frequent fatal consequences thereof.

It was of course to be expected that *The Engineer* would attempt to make what capital it could out of this disaster, and as it has never been afflicted with a very long memory it has probably forgotten all about the Tay bridge disaster, so recent as Dec. 28, 1879, and which was beyond doubt the worst disaster resulting from *lack of engineering knowledge in men of recognized standing* which ever occurred. For the engineer of that structure stood near the top of his profession, and was knighted for that very structure, yet it was so very defective that it fell for want of that most elementary requirement of construction, proper bracing to make it theoretically rigid. While the engineering ignorance displayed was perhaps not greater or so great as in the Bussey bridge, yet it was on a vastly larger scale, and had a large number of other engineers mixed up in it as subordinates, inspectors, etc., so that, considered merely as a comment on the skill of engineers, the Tay bridge was vastly the worse. In fact, as we have stated, what makes the story of the Tin Bridge so peculiarly discreditable is, that engineers had nothing to with it, from beginning to end.

This sort of "you're another" argument is poor business, we admit, but as the children say, "*The Engineer* began it," and we leave them now a monopoly of it. One lesson it does teach, however, that unwarranted exaggeration of facts as to the frequency of such disasters, such as we noted last week, may rise, to the dignity of a national injury, quite independent of their real value as evidence.

We have good engineers in greater abundance than *The Engineer* seems willing to give us credit for; and as railway directors are not likely to carry their ideas of bridge construction into foreign colonies, where somebody else is to pay for them, the American engineer has a fair chance, and the English colonists need have no fear of his works.

THE delay in making public the official findings as to the "Tin Bridge" disaster is so astounding, and so far beyond all reasonable and rational explanation on an ordinary basis, that one can only believe that there must be some peculiar and exceptional cause for such strange delay, as in some elaborate technical presentation of the facts, or carefully prepared piece of legislation, which, when it appears, will amply excuse it; or at least go far to do so, for it is hard to see how anything can do so altogether. The accident occurred on March 14. The five experts testified that they were from the very first satisfied as to the cause of the disaster, and never had but one theory about it. Yet it was not till the very end of the investigation, which closed April 4, that they were put upon the stand, and although their testimony left no room for any shadow of doubt, as to the cause and character of the disaster—granting by courtesy that there has been any room

for doubt from the first day of the disaster—no "findings" have appeared as we write 18 days after the hearing closed. The circumstances are such as to raise grave apprehensions as to the final outcome, but we shall continue to hope that it will in large measure explain and excuse the delay. Otherwise the investigation would be even more discreditable to Massachusetts than the disaster itself.

WE regret that we are unable to present in this issue some further facts which have come to our knowledge, and which are certainly of great and general interest, in respect to the Bussey bridge catastrophe and in respect to the LATIMER safety-guard. In part, this is for lack of space; in part, because we desire to give fuller drawings than we can prepare for this issue, and in part, as respects the Bussey bridge, because we agree with one of the Boston papers, that we have said and done quite enough to bring out the facts in advance of the official findings, and as it has taken us (as we admit with shame) a whole month and more to find out the further facts referred to, and as no other paper seems to have found them out at all, it is but just and reasonable to leave them to appear first in the official report, which will no doubt set them forth in full, and comment upon them as their nature requires.

While we are speaking of the Boston papers it occurs to us to note that one of them drew a powerful picture of the joy in this office over the possession of "what is called in newspaper parlance an 'exclusive'" as to the Bussey bridge. It appears that we did have an exclusive, but certainly a most unexpected one, and not of the nature which our daily contemporary seems to fancy, since *the other half* of the same evidence from which we obtained our "exclusive" remained upon the ground to tell its wretched story to all who chose to hear. That there was anxiety enough to get at the facts is undoubted. The following little picture from the Boston *Globe* of the day following the disaster, graphically illustrates one phase of it:

REPORTERS STUDYING THE CAUSE OF THE DISASTER.

But to this day the whole Boston press, and what is far less to its credit, the so-called "technical press," (a few journals excepted) knows nothing which it is willing to tell about the real facts, although they were determined and published by this journal within three days after the disaster, and have not been added to or taken from in a single important detail by anything which has since appeared from any source. As respects what we have already published, this ignorance is assumed, of course. As respects what we are about to publish—after it has appeared in the official findings—we must in candor admit that their ignorance is very real indeed, and their utter silence not intentional.

WE have received this week, as we do almost every week, inquiries for a "good book on cable railways," for a "good book on well-boring, water and oil, describing methods, apparatus, pumps, and everything connected with such work," for "a book on construction of street railways, horse, motor, cable and electrical" and for "some books on architecture suitable for railway purposes." We regret to say that the same answer hits every one of these queries: There are books which contain information on all these subjects, but they are few and far between, and we know of none which we can recommend when applied to in this way. The most valuable and definite information on each is scattered through the past volumes of our own and other technical periodicals, and if our correspondents will excuse us, we are unwilling to give the time necessary to a search of even our own files so as to supply a reference to numbers which we probably could not furnish if ordered. On July 25 and Aug. 8, 1885, however, we published some articles on well-boring, and in the last two years have published a good deal on street railways. The annual report of the American Street Railway Association contains more information on horse-railways than we know of in any other place between two covers, but it is not for sale. *Engineering*, about two years ago, published a valuable series of articles on the Chicago Cable Railways, and in fact that subject has been exceptionally well written up, but in a scattered form. As for such an architectural book as that referred to it does not exist.

In this connection we may add that there are many special subjects of this nature, which will amply warrent the publication of a volume devoted to them, if industry and care be used to collect *all* the facts and *all* the details which are of importance to the man who is looking up the subject. Literary skill is of small importance in such a work compared with industry and thoroughness, and if any one has stowed away in his desk a manuscript so prepared for a book on any one of the above subjects, or on a number of others of a similar nature, which we might mention, we will guarantee to find him a ready publisher.

A NOVEL type-setting machine, the only one of its kind in the world, we believe, is in use on the *New York Tribune*. The types are steel dies, and the matter is set up a line at a time, then quickly "justified" or spaced out between the words so as to exactly fill the line, and then an impression or stereotype of that one line is taken in type-metal, and the work proceeds. The result is a series of stereotypes of just the length and width of one line each, which are put together like a pack of cards in their appropriate column. It is necessary that the "copy" should be very correct, but a little machine is provided by which the lines can be cut up into words, when necessary and a new word or more correctly written word substituted.

This is a quite different method from that of the ordinary type-setting machine, which sets the type in much the same way as by hand. The latter has been very extensively used both here and abroad, and has had a certain success, but not enough to bring it into general use.

The details of this new machine are kept very close, and no one is allowed to see it; but it is rumored in a less authentic way that it is provided with certain stops, like an organ, marked "mugwump," "Cleveland," "*Times*," "Geojones," "*Evening Post*," etc., so that, by pulling out the proper stop the desired tone can be given to the article without the usual wearing draft on the intellectual faculties of the editors. Whether these stops are like the politician's principles,—"If they don't suit, gentlemen, they kin be changed"—or whether they are immutably fixed in the nature of the machine, does not appear. From the fact that the machine is used only by the *Tribune* we infer the latter. A large part of the editorial page of the *Tribune*, and much of the other matter is set up on this machine daily. The work done on it can be distinguished from ordinary hand composition, on the editorial page at least, by the fact that the lines are a little more widely spaced than the hand work. It is further claimed that by careful scrutiny of the machine articles it can be detected what stop has been pulled out.

WE understand that it has now been pretty well determined to hold the coming convention of the American Society of Civil Engineers at the Hotel Kaaterskill, at the top of the Catskill mountains, and that the time will be Fourth of July week. The choice has lain between this point, Old Point Comfort, Lake George and Newport, but independent of the other great advantages of this point, the fact that the Poughkeepsie bridge is now in course of erection, and will be, at about that time, at its most interesting stage for examination, appeared to be decisive in its favor, so that, although changes are always possible until all arrangements have been made, it is not likely that there will be any change from this programme and we risk little in predicting that it will result in the largest and most successful convention which the Society has ever had, as the locality is not only very convenient of access, but one of the most delightful spots to visit in the United States.

It is probable that a steamboat will be chartered to take the party from New York, and that a stop of some length will be made at West Point, proceeding thence to the Poughkeepsie bridge, when lunch will be taken, and thence by special train over the mountain railway to the hotel for dinner. The Fourth of July, this year, comes on Monday, and whether the start will be made the Saturday before the Fourth, giving a day or two of leisure on the mountain top before the "trouble begins;" or whether it will be on the following Tuesday is as yet undecided. We suspect it would be more generally popular to make the early start, although to some it might be inconvenient.

DES MOINES Co., Iowa, is taking some increased interest in its highways; and the Burlington *Hawkeye* practically repeats our recommendations of a week ago regarding the appointment as a county engineer who shall be responsible for roads and county structures. The difficulty of persuading farmers to "work out" their road tax with any good results, and the money annually wasted upon inadequate structures is being felt. We understand that the Iowa Society of Civil Engineers is taking steps in the direction of some improved system of appointment to engineering offices, and the better insurance of fitness for office by training and experience.

THE readers of the *Mining Herald and Colliery Engineer* are puzzling over the problem: "What is the longest rigid line that can be passed down a shaft 4 ft. wide into a drift 8 ft. high at the bottom of the shaft." It is not quite so easy a problem as it seems, being somewhat similar in its nature to the old one as to the length of the braces of a Howe truss, but it admits, we think, of a neat and brief solution.

IT has been suggested that the Inter-State Commerce bill was passed with the especial purpose of giving the men who run railroads on paper an opportunity to see how their theories would work in practice. It already looks very much as if the theories, the railroads and the public had about all it wanted of the new law, especially in its "long and short hand" features.

New York Rapid Transit.

An unusually determined effort appears to be now making to push through an elevated railway scheme on Broadway. All the daily papers have been filled for weeks, as they have not been for years before, with matter for and against the scheme—much of it, plainly of the class paid for at so much a line—and various other schemes for extensions of the existing lines, arcade railways and what not, are pushed with almost equal vigor. Where there is so much smoke there must be some fire, and the circumstances make it highly probable that within a short time material additions to the existing facilities will be begun somewhere, although it would as yet be quite impossible to predict just where and just what they will be.

That there is absolute necessity for some great addition to existing facilities is very plain. One has only to make a few trips over the existing lines to see that their limit of reasonable capacity has been reached and passed, but why this is so, and how certain the traffic is to multiply hereafter in a rapid geometrical ratio can best be seen by a glance over the entire history of transit facilities, such as is made possible by the table showing the growth of New York city internal passenger traffic presented herewith, which contains some figures which have never been in print before, viz., the extraordinary and at first sight incomprehensible increase in the number of trips made *per inhabitant*.

These figures, it should be carefully noted, extend only through the year 1885, and do *not* include the enormous increase of travel since that date which has resulted from the lowering of the fares on the elevated lines, and which has already about doubled their traffic from the average of 1885, although the increase has but begun. Inasmuch as both the growth of population and of travel are in geometric ratio, we can best see what are the probabilities of the future growth of both for a few decades ahead, by comparing the logarithms of the past figures, which we need hardly say will be in arithmetical ratio when the figures themselves are in geometric:

LOGARITHMS OF PAST POPULATION AND TRAFFIC.

Year.	Population.		City Trips.	
	Logs.	Diff. of Logs.	Logs.	Diff. of Logs.
1855	5.79921	.....	4.26689	.....
1860	5.91045	0.11124	4.56176	0.29487
1865	5.94250	0.03205	4.91410	0.35234
1870	5.97419	0.03169	5.06123	0.14713
1875	6.01920	0.04501	5.22251	0.16128
1880	6.08146	0.06226	5 32476	0.10225
1885	6.14395	0.06249	5.47293	0.14817

Between 1860 and 1870 there was a sharp check to the growth of New York city, resulting from the war, but the average difference for the logs. of population, for the whole 30 years, was 0.11500, or 30.3 per cent. increase per decade, *including* this effect of the war. Taking only the 15 years since the war, it will be seen that 0.06000 per half-decade, or 0.12000 per decade (31.8 per cent. growth) is a reasonable average to take for computing future growth. It may seem impossible that the increase can continue geometric, but the whole tendency of modern history shows that the *rate* of growth, as well as the absolute growth, increases with the size of cities. The diagram prepared by Mr. RUDOLPH HERING showing the growth of our leading cities, which was published in our issue of Jan. 15, 1887 is only one of many evidences of this, but a very striking one.

The logs. of the growth of travel show an even more closely approximate ratio. The average rate for the past 30 years was 0.40201 (52.35 per cent. growth) per decade, but as this runs back to the very beginning of city traffic on a large scale, the per cent. of growth in the earlier years is disproportionately high. Taking only the last 15 years the average is 0.13723 per half-decade or 0.27446 per decade. Assuming 0.27000 as the probable constant difference of the logarithms for a few decades ahead, we have:

LOGARITHMS OF FUTURE POPULATION AND TRAFFIC.

	Assuming + 0.12000 per decade.	Assuming + 0.27000 per decade.
1890	6.26395	5.60795
1900	6.32395	5.87795
1910	6.44 95	6.14795
1020	6.56395	6.41795

Taking out the numbers corresponding to these logarithms, we obtain the following comparative figures:

	Population.	City Trips. (Thousands.)	Trips per Inhabitant.
1890	1,599,400	405,460	253.5
1900	2,108,600	755,000	358.1
1910	2,779,300	1,405,900	505.8
1920	3,664,000	2,617,900	714.5
Against			
1885	1,393,000	297,117	213.2
1875	———	166,918	159.7
1865	———	82,055	93.8

The last column of these figures, showing the number of trips per inhabitant which result from such a computation of probable future population and travel, appears to invalidate the latter, for it requires that the number of trips per year per inhabitant shall increase from 213, as in 1885, to 714 in 1920. It is not at all probable, it may be readily admitted, that the time will ever come in this city when every man, woman and child in it will take nearly two trips per day within the city, instead of about two-thirds of a trip as now, although the proportion per inhabitant will certainly increase. But then, there are two important factors in this calculation which have not taken into account as yet; viz. (1) many city trips are taken by people who do not live in it, and the proportion of such will increase, and (2) and far more important, the average *length* of trip tends to increase with the growth of the city, and the effect upon carrying capacity is much the same, if not upon revenue, whether the number of trips doubles, or their average length doubles. No means exist, nor are ever likely to exist, for estimating directly how important is this difference in length of trip, but we may get some idea of it indirectly by considering another fact of momentous importance in its bearing on this question.

By consulting the large table which we publish it will be seen that the horse-car travel per inhabitant has about reached a constant rate of some 130 or 140 trips per year per inhabitant. Contrary to what is universally supposed, the horse-car travel has not appreciably fallen off per inhabitant, but the table affords the strongest presumptive evidence, as does reason and observation, that it will not grow hereafter much faster than the population. Now, the horse-car travel is confined almost exclusively to short and occasional trips. Any one going more than a mile seeks the elevated lines if possible. Therefore, it is at once apparent that the demand upon the horse-car lines is not increasing much faster than the population, nor is the average length of trip on them increasing, to any important extent, *but all the increase in* NUMBER *of trips and all the increase in* LENGTH *of trips is concentrated on the elevated lines.*

It is to be further remembered, in considering this problem, that there will be in the near future a great city above Central Park, and another great city above the Harlem River, each of which will approach closely in population to the city below Central Park, which latter must forever remain the great business center. The effect is that not only the daily trips to and from business multiply in number and length, but that the trips for calling, for shopping, for going to school and market and theatre and church, for all sorts of business and social purposes, do so likewise, not only because of the greater distances, but because the greater population brings more people, and more places to visit, within convenient access. When in addition to all the preceding the peculiar geographical conditions of New York are remembered, there seems no reason to believe that the figures last presented give in any sense an exaggerated view of the probable demands of the future for what we will call by courtesy "seating" capacity, for the next two or three decades at least, and for that length of time we are led directly to the following conclusions:

1. *The aggregate demand upon city transportation facilities will continue for some time to come to about double every ten years*, considering both number and length of trips.

2. *The great bulk of this increase will be concentrated on lines supplying such facilities as the existing elevated railways*; SO THAT ON THESE LINES THE DEMAND FOR SPACE WILL CONTINUE FOR SOME TIME TO COME TO DOUBLE EVERY FIVE OR SIX YEARS.

Here we have in a nutshell the problem with which New York city is confronted, and with which it is pottering and trifling in what seems to be the inevitable fashion. Could a little more foresight have been shown in planning the existing lines, so that they should have been made strong enough to carry ten-car instead of five-car trains, and four-track instead of two-track lines the city would not yet, at least, be in so bad a state as now, nor be obliged to forego that reasonable comfort in transit which can so amply be afforded and yet leave a large profit on the actual investment. The Third Avenue line is now adding an additional track on the existing structure, but this is only a partial relief. It was perhaps too much to expect that the future should be anticipated when the elevated lines were first built, but now we have an ample basis of experience to go upon, and it will be a public misfortune if its teaching is not comprehended in time. We had intended to say something in respect to the latter but we must postpone all attempt to do so to another occasion.

The Demand for Civil Engineers.

There is an active demand for civil engineers. It comes from very reliable parties. Our advertising columns show this in part; but we have also several personal inquiries each week by callers at our office. As examples, JAS. W. FOX, of 36 East 21st street, N. Y., wants an engineer to locate and build a short line of railroad in Kentucky, for the Proctor Coal Co.: Mr. MOUNTFORT, Resident Engineer of the Louisville & Nashville R. R. Louisville, Ky., wants six or seven engineers: the Canadian Government is also advertising this week for an engineer. This demand is reasonable and seasonable in view of the present activity, especially in the South and West. Not only railroad but water-works and sewer construction is in progress in every corner of the continent. There is no doubt that the ensuing five years are to be very prosperous for all classes of construction work. Contractors are busy and correspondingly happy, and if the civil engineers of this country do not improve their present opportunities for active employment, they are not likely to find much better ones by waiting.

But the very fact that the demand for engineers is active, makes it difficult to secure good men when wanted; and yet, because of the enormous size of the country, there are always good men in the best of times who need positions and are fitted for them, but who do not get them simply because they do not know where to look. This makes it particularly appropriate for us to call the attention of both employers and employés to the advantage to be had from the use of our "want" columns as the most expeditious and the fairest method of making known their wants. When it becomes universally known that such wants are specially advertised in one journal, it is to that journal all parties will turn for desired information. If scattered through a number of papers there will be universal disappointment. Without undue vanity we may fairly say that ENGINEERING NEWS is now accepted as *the* engineering newspaper of America, and that it is to it that engineers and the employers of engineers must naturally look to supply their respective wants. In England advertising engineering vacancies or the want of them is constantly practiced, and it is too evident for discussion that the very nature of engineering work makes it the only possible way to enable both sides to such engagements to do the best for themselves possible.

"Let the best man win," and "give every man a chance" should be the motto of employers. Moreover, use the facilities which exist freely and the facilities will improve proportionally. We write in the interest of engineers everywhere—especially young men—and not our own, although, of course it is for our interest likewise. But as we are indebted to the civil engineers of America for the prosperity of this journal so we regard it as a duty and pleasure, as well as for our interest, to employ its advantages in promoting their interests, and we can do so very effectually, if those having positions to fill will aid us in doing so.

We trust no one will misunderstand the purpose of this article. We are not seeking advertisements, as such, but we do have it constantly forced upon our attention that there is the greatest need of such an established *and constantly used* channel for communication between engineers and those who need their services as can only be obtained through the columns of an engineering journal. Every man owes it to himself and his profession to do what he can to bring this about, and we feel the more free to say this that it does not benefit us appreciably in a money way, except that it enables us the better to fill our aim to publish a journal which shall be USEFUL TO ENGINEERS in every way. In that respect of course it does benefit us, which we hope will be felt to be only an additional reason for doing as we suggest.

THE Kensington Parish (London) Board reports that it transports its 37,000 loads of house refuse and 24,000 loads of street refuse annually to a brick-field just outside its limits; it there disposes of a portion by screening out the sand and grit and making these screenings into brick, and burns another portion in the open air; still a certain part must be "barged" and dumped into the sea beyond the Nore. The "barging" costs from 1 s. to 2 s. 6 d. per ton, while the screening and burning costs 3 d. per ton. The total cost of annually disposing of 61,000 loads of refuse costs them £25,000. The parish is now seeking powers to erect a "Fryer Destructor," with 20 cells, in each of which 6 loads can be cremated in 24 hours, the heat employed being equal to 1800° Fahr. The road refuse is to be washed and screened at a cost of 8 d. per cu. yd. and is expected to yield sand worth 5s. per cu. yd.

Growth of New York City Internal Passenger Traffic.

[TABLE 192, from the forthcoming edition of "The Economic Theory of the Location of Railways," by A. M WELLINGTON, C. E.]

YEAR.	Estimated and Actual Population.	CITY PASSENGER TRAFFIC (Thousands).			PER INHABITANT.		
		Elevated loads.	Horse Cars.	Total.	Elevated.	Horse.	Total.
1853	581.	None.	6,836	6,836	.....	11.8	11.8
54	608.	"	6,817	6,817	.....	11.3	11.3
1855	629,810	"	18,488	18,488	.....	29.4	29.4
56	663.	"	23,153	23,153	.....	35.0	35.0
57	698.	"	22,190	22,190	.....	31.9	31.9
58	734.	"	27,900	27,900	.....	38.0	38.0
59	773.	"	32,889	32,889	.....	42.7	42.7
1860	813,669	"	36,455	36,455	.....	44.7	44.7
61	826.	"	26,272	26,272	.....	31.8	31.8
62	838.	"	35,878	35,878	.....	42.8	42.8
63	850.	"	40,412	40,412	.....	47.6	47.6
64	863.	"	60,900	60,900	.....	70.6	70.6
1865	876.	.....	82,055	82,055	.....	93.8	93.8
66	889.	.....	88,953	88,953	.....	100.0	100.0
67	902.	.....	100,542	100,542	.....	111.0	111.0
68	915.	.....	105,817	105,817	.....	115.6	115.6
69	929.	.....	114,349	114,349	.....	123.5	123.5
1870	942,292	.....	115,139	115,139	.....	122.0	122.0
71	962.	.....	133,894	133,894	.....	139.4	139.4
72	982.	136	143,561	143,697	0.1	146.0	146.1
73	1,003.	644	144,715	145,359	0.6	144.4	145.0
74	1,024.	796	151,131	151,927	0.8	147.8	148.6
1875	1,045,223	921	165,997	166,918	0.9	158.8	159.7
76	1,076.	2,013	166,401	168,414	1.9	154.5	156.4
77	1,107.	3,012	160,924	163,936	2.7	145.3	148.0
78	1,139.	9,291	160,899	170,190	8.1	141.0	149.1
79	1,172.	46,043	141,939	187,984	39.4	121.4	160.8
1880	1,206,299	60,832	150,390	211,222	50.5	124.7	175.2
81	1,242.	75,586	155,801	231,387	60.8	125.4	186.2
82	1,278.	86,361	166,511	252,872	67.6	130.8	198.4
83	1,315.	92,195	176,625	268,750	70.1	134.2	204.3
84	1,354.	96,703	187,413	284,116	71.5	138.2	219.7
1885	1,393.	103,355	193,762	297,117	74.2	139.0	213.2

Summary.

YEAR.	Population.	TRIPS PER INHABITANT.			NO. OF LINES.		No. Trips per Inhabitant *per* 100,000 *of Population.*
		Horse.	Elevated.	Total.	Horse.	Elevated.	
1853	581.	11.8	.....	11.8	2	..	2,03
1855	630.	29.4	.....	29.4	4	..	4.67
1860	814.	44.7	.....	44.7	6	..	5.5
1865	876.	93.8	.....	93.8	12	..	10.7
1870	912.	122.0	.....	122.0	12	..	13.0
1875	1,045.	158.8	0.9	159.7	19	1	15.3
1880	1,206.	124.7	50.5	175.2	23	4	14.5
1885	1,393.	139.0	74.2	213.1	25	4	15.4

CORRESPONDENCE.

The Library of the American Society of Civil Engineers.

NEW YORK, April 16, 1887.

EDITOR ENGINEERING NEWS:

I fully endorse the views expressed by you in your last number, regarding the importance of exciting interest in the formation of a good technical library in this city. And as a commencement, I will be one of twenty or more persons to contribute one hundred dollars each to purchasing additional books for the library of the American Society of Civil Engineers. This sum, with the amount which is now annually appropriated by the Society for library purposes, should enable the more important technical publications at least to be well kept up.

Yours truly, EDWARD BATES DORSEY,
M. Am. Soc. C. E.

[We will cheerfully receive and report the names of all others wishing to join in the above contribution.—ED. ENG NEWS.]

[MR. DORSEY'S generous offer, which was called out by our talk in the matter, seems to make it almost incumbent on us to subscribe another $100, or stand convicted of being ready to talk only, and we subscribe with pleasure. It is taking hold of the matter at the right end to try to have the societies show some interest in their libraries individually before they attempt to coöperate; and as the American Society already has a good foundation, and is the only society which has, we cannot but believe that an active effort to make its library what it might be and what it should be, would do far more good in the end than the more ambitious project.

We will cheerfully receive and report the names of all others who may wish to join in forming the suggested small fund, and we sincerely believe that $100 now will do more good than $1,000 ten years from now. "It is the first step which costs." If a beginning is once made—if the Society will only show a little interest itself in its library, and show that it means to do all it can to have at least one worthy engineering library in the country, bequests and donations, both of money and books, will speedily begin to flow to it. But "there must be fire to start fire." Until the Society is willing to do a little at least for its own library, no individual can be expected to do much. The library, as it is to-day, is a melancholy spectacle. There is a great deal of most valuable material there, which it would cost a large sum to duplicate, but even the most essential current publications cannot be bought as things are now, nor necessary arrangements made for obtaining and caring for what can be had for the asking. A subscription of $3,000 or $4,000 to remedy the most pressing defects would not only be of great value directly but be of even more indirect value for its moral effect.—ED. ENG. NEWS].

The Need for a National Engineering Society

TOPEKA, KAN., April 10, 1887.

EDITOR ENGINEERING NEWS:—

I have read with pleasure your able article on the need of an engineering standard, which shall make membership in the American Society of Civil Engineers, as the only existing national organization, incumbent on every person aspiring to be considered a competent civil engineer, and to practice as such.

The growing need of such a standard is every year becoming more and more apparent, as the profession becomes more crowded, especially in the West, where at present, owing to the demand for engineers on railroad work, it is no uncommon thing to see some high school student go out as rodman in January, get a level in June, in the following January go through the form of running a transit, and perhaps in six months more, owing to pressure, obtain charge of a subdivision of construction, or even a

field party; while perhaps working next him is an experienced man, who does his work thoroughly, but does not push himself forward; and owing to there being no standard gauge of a man's training, the young man possessed of some push, and probably considerable bluff, without any knowledge whatsoever of the real principles of engineering, manages to scramble through his work, because the engineering department of the company he is working for is strained to its utmost with work, while his co-worker turns in his work with professional exactness, and the same reason that saves the one, prevents the other being thoroughly appreciated.

I might instance another common occurrance in the West, that of county bridges, etc., where the designer or inspector is generally the county surveyor, thoroughly competent no doubt so far as land surveys are concerned, but sometimes destitute of all technical knowledge of mechanics, or practical bridge work; and therefore utterly unqualified to pass judgment on structures, on which the public safety depends.

Should your suggestions be acted upon, there would be more reliable men entering the profession and sticking to it, and fewer young men going into it for a few years, because they can quickly earn a good salary, and then, when they are really becoming useful, leave it for something else.

Yours truly, A UNIVERSITY GRADUATE.

False Skew Arches on the D. & B. B. R. R.

DU BOIS, Penna., March 30, 1887.

EDITOR ENGINEERING NEWS:

Reading in your valuable journal, of March 26, the article on "False Skew Arches," by Mr. P. F. BRENDLINGER, C. E., I wish to add to his views and experience my own, and state that when in charge of the construction of the First Division of the Delaware & Bound Brook Railroad it became necessary to build a two span arch culvert of 20 ft. opening each, on an angle of 61° with the center line, I conceived the idea of building this with courses parallel with the axis of the arch, and cutting from the ring stones the angle made by the center line and direction of the arch, furnishing the contractor with a template for the face of the ring stone and pattern giving the angle to be cut off.

Submitting my plans to the chief engineer, Mr. F. H. SAYLOR, I was encouraged by his hearty approval. I proceeded with the work, simply staking out the arch for the face lines as for a straight arch, from which the masons worked, with lines drawn from stake to stake.

This arch was built in 1875, I have never heard of its showing the least sign of weakness. It is located about a mile east of Pennington, in Mercer Co., New Jersey.

Believing this to be one of the first, if not *the* first, two span arch of this form built in this country, I think it might be well to put it on record.

Yours truly, HERMAN S. MACMINN.

Upset Screw Ends.

BROOKLYN, N. Y., April 16, 1887.

EDITOR ENGINEERING NEWS:

I notice in this week's ENGINEERING NEWS, a communication from Mr. LOWTHORP, citing some tests of screw ends in which the "*sound or unwelded*" part of the bar broke. He quotes this as showing that upsetting does not injure the bar.

He does not state the relative diameter of upset, *under* thread nor whether the upset was exposed to a strain equal to that of the bar or was shielded from it by the nut. Yours truly,

H. B. S.

SOCIETY PROCEEDINGS.

The American Society of Civil Engineers.—Meeting of April 20; President, WM. E. WORTHEN in the chair. The evening was given up entirely to the continued discussion of the paper of Mr. WM. METCALF, on "Steel; some of its properties; its use in Structures and Heavy Guns."

Commander C. F. GOODRICH, U. S. N. was sure the Navy would welcome any guns as efficient, light and safe as those now coming into use, especially with the added merit of greater cheapness. He thought the interest manifested in this question by engineers, was full of promise to navy officers.

Lieut. F. M. BARBER, U. S. N., said that the well known reputation of Mr. METCALF entitled his opinions on heavy guns to more consideration than that of any other metallurgist in the country, for he had made guns, and was the only practical expert who advocated the casting of high-power guns on the Rodman principle. He had not been able however, to find any record on file in the War and Navy Departments of any successful casting of unforged steel guns, except in field-pieces. Lieut. BARBER quoted the opinions of other steel makers to prove that the thing was yet untried and its practice would be accompanied by great risk, and that the production of castings of any dimensions in steel of a well determined chemical composition, combining the resistance and rigidity of steel with the smooth surface and homogeneity of cast-iron was a very complicated problem. He referred to Swedish experiments, and the Whitworth's patents in support of his argument that the pieces of a gun must be tested separately and in comparatively small parts, and then built-up. He referred to a 15 in. Rodman gun, cast in 1863 and fired 100 rounds, and when this gun was cut 2 in. deep by a tool where it was 44 in. in diameter, it cracked entirely through for three-fifths of the circumference, showing it had been under great strain for years.

Lieut. BARBER thought there was some confusion of ideas on casting steel guns on the Rodman principle as shown in the arguments of Mr. METCALF, Mr. HOLLY and Capt. MICHAELIS. In regard to failure of Rodman guns, he said there was a list of 249 guns of cast-iron which had burst, mostly during the war. Of these 141 burst under fire, 10 burst spontaneously and 98 cracked, fissured or were ruptured before proof. Of those failing under fire, 86 were Parrott rifles, 6 were Rodman rifles, 29 Dahlgren rifles, 18 Rodman smooth-bore, and 2 Dahlgren smooth-bore. The speaker thought the built-up gun was as much American as European as the best system of breech closure, and best gas-check was American; slow-burning powder was American, and so were the best machine guns, small-arms and cartridges; round forged projectiles, expansion—bands, and rear fuses were all American.

Lieut. R. R. INGERSOLL, U. S. N. did not deny the good qualities of Rodman cast-iron guns, but when the system was applied to steel, and this cast-steel gun then annealed, he had doubts concerning the effect of this process on the elastic strength of the finished guns in regard to initial tension.

Lieut. AUSTIN M. KNIGHT, U. S. N. said naval officers had within the last five years the following problem submitted to them;—Given a sum of money, how shall it be invested to produce a certain number of guns of given weight and power and of the greatest degree of reliability? Most army and naval officers favor built guns because 50,000 such guns are in foreign service and in fourteen years only ten have burst. The Navy might have tested all systems, but the question arises—what constitutes a test. Such tests could not have stopped with any moderate number of guns and would have involved vast expense and long delay. The alternative was to adopt the system that had the weight of evidence in its favor and this was done.

Mr. WM. SELLERS was not prepared to deny the possibility of a gun made of a solid mass of cast steel, but he doubted it; he did not think it was likely to be the cheapest gun either. With present high standard of quality maintained a notable quantity of gun-castings would be condemned; it would cost more than the material was worth to get these condemned guns into pieces small enough to remelt, and this cost must be added to that of the good castings. He thought the casting of an ingot heavy enough for the tube of a 16-in. gun and then boring and forging it would be attended with less risk, than to cast on the Rodman principle. He thought the present built-up gun could be improved upon in construction and that an American gun could be built which would show greater muzzle velocity and endurance than anything yet made, or that could be made in one solid piece.

Mr. CHAS. A. MARSHALL said that we now wanted rifled guns capable of standing high powder-pressures. In regard to the built-up gun, it was made of moderate sized ingots which cool quickly and lessen the tendency of the carbons and metalloids to separate; the central part is bored out and piping injury is eliminated. The disadvantages of casting the whole gun on the Rodman system were the greater weight and size of castings; largely increased risk, slow cooling and consequent large, weak crystals and low elastic limit of the outer metal, and a maximum elastic limit of interior metal of not over 29,000 lbs. per sq. in. for the hardest steel used in guns at present. Mr. MARSHALL exhibited three tests in support of this last assertion, and then described the 8-in. hooped steel rifle-gun recently built and successfully tested: and from these tests argued that the elastic limit in the interior of the cast gun should reach 50,000 lbs. He thought that trouble would be found in the slow cooling of a cast-gun, as it would favor large crystals and permit a change in the condition of carbon.

Mr. HENRY M. HOWE anticipated that gun steel, owing to its high melting point, consequent enormous contraction in cooling, escape of gas during plastic state and consequent formation of blow-holes, would be far more difficult to treat on the Rodman principle than cast-iron, still these difficulties are hardly as formidable as those which Rodman overcame, and Mr. METCALF's belief that they can be overcome, is extremely encouraging, as his knowledge and experience carries great weight.

The great advantage of the application of this principle to gun-steel would not be in first economy alone, but in the great gain in time of execution. As to the testimony of KRUPP, WHITWORTH, SCHNEIDER, etc., Mr. HOWE thought that it was evidence and argument and not weight of names that settled the living questions of to-day.

Mr. HOWE then presented the results of some experiments on the sudden cooling of steel. He took ¾-inch round bars of machinery steel, of 0.39 carbon, quenched them suddenly in cold water from white heat. He found the tensile strength exceedingly high, in one case rising to 248,000 lbs. per sq. in.

Mr. M. J. BECKER spoke of the abandonment of the use of cast-iron in structures owing to the general uncertainty of the product and the difficulty of producing a shell of uniform thickness. He has noticed, however, of late that leading bridge-builders are returning to the use of cast metal in large structures, and the employment of soft, malleable cast steel. In answer to a question on that head, Mr. METCALF said that he would recommend for such castings, dead soft steel, thoroughly annealed.

Mr. A. E. HUNT presented in tabular form the result of a series of tests in tensile and bending stresses. A plate of soft, open hearth, fire-box steel, ⅝ in. thick and having 0.12 carbon, 0.36 manganese, 0.008 silicon and 0.017 sulphur, was cut into strips 1¾ in. wide and long enough to get a tensile and then a bending test out of the end projecting from the testing machine grips; these pieces were prepared with a planer with straight edges so as to have all the effects of the shearing removed. These pieces were subjected to both tensile and bending tests; some in a normal state and others after being heated to the various temperatures shown in the table; some were heated thoroughly and uniformly and carefully annealed in hot sand; others were cooled at the temperature of the air, and others again plunged into water at 60°, into brine at 60°, and into oil at 60°. Mr. HUNT's experience from these and many other tests, is that 0.10 carbon steel refines or anneals so that its grains are most uniform and fine at a temperature of about 100° Fah.; it appears as a medium orange color, considerably below the lemon color. The tests confirm Mr. METCALF's rule that the best heat to harden it, is the one at which the metal is most thoroughly annealed.

The crystalline character of iron and steel certainly undergoes a change due to temperature; and Mr. HUNT further agreed with Mr. METCALF in his advocacy of the Rodman principle, and gave a table of tests of specimens cut lengthwise and transversely from forgings made for two of the first 6 in. B. L. built up rifles made for the Navy Department. The results of these last show that the temperature to which the steel was last subjected, moderated by its subsequent treatment is always recorded in the structure of the steel, and that annealing is one of the most important operations.

Mr. JOHN COFFIN presented a summary of conclusions of an article written by Mr. J. A. BRINELL, referring to the theory that change in the structure of steel is always accompanied by change of "cement" carbon to "hardening" carbon.

Prof. JOHN W. LANGLEY thought that steel is a fluid, both as to mechanical tests and to chemical behavior. He did not consider it a good working hypothesis to regard the carbon, phosphorus, etc., in steel as being present in solution and not as definite carbides. It is probable that many of the well-known peculiarities of iron and steel may be explained and industrially dealt with, with some measure of success, in proportion as we treat the problem as essentially a problem of a viscid fluid.

Mr. W. H. BURR gave the result of recent experiments in structural mild steel, showing that 65,000 lbs. tensile steel possesses a compressive elastic limit of from 40,000 to 42,000 lbs. per sq. in.; while 80,000 lbs. tensile steel possesses an elastic limit of not far from 45,000 to 48,000 lbs. per sq. in. in compression. Comparing these results with 26,000 or 28,000 lbs. elastic limit for wrought-iron, it is reasonable to infer that the working stress in even 65,000 lbs. tensile steel columns may be safely increased from 33 to 50 per cent. over that used for wrought-iron under similar circumstances. He did not think modern experience with steel castings would justify confident expectation with regard to steel cast guns internally cooled.

Mr. A. GOTTLIEB did not agree with Mr. METCALF's definition that steel is a liquid; he said that it is and

always would be a treacherous material; failing from a few degrees too much or too little heat, from unequal heating or cooling, from a blow-hole or even a scratch. He favored hydraulic pressing and the hammering of large masses.

Mr. PERCIVAL ROBERTS, JR. agreed with the author in his views of the effect of heat on steel. He suggested that in present practice we give too much importance to tests of steel under conditions entirely foreign to its existence in the finished structure, and not enough of importance to tests of material *within* the elastic limit instead of testing to destruction.

Mr. D. J. WHITTEMORE said that in his experience steel as a rule suffers about 10 per cent. in strength value after it leaves the mill and has gone through the necessary shop manipulation to be transformed into bars for bridge purposes. As this is also a characteristic of iron members, its prevention becomes a question worthy of serious consideration.

Mr. SAMUEL T. WAGNER referred to the necessity of greater care in preparing small test pieces and to the necessity of greater care in heating steel. He quoted the case of 60 pieces heated on top of a close anthracite fire to the desired temperature with perfect uniformity, of which all failed to bend as required, though a second lot from the same bars, heated as usual passed the test very well.

Jos. M. WILSON agreed with the author's remarks on the crystallization theory; he had tested wrought-iron after twenty-five and thirty years use, where it had been considerably overstrained, and found it practically in as good condition as when first in use.

Engineers' Club of Philadelphia.—Record of regular meeting, April 2d, 1887. President T. M. CLEEMAN in the chair; 32 members and 5 visitors present. The Tellers of Election reported that the following were elected Active Members of the Club: Messrs. CONWAY H. DAY, LINO F. RONDINELLA, HENRY S. PRICHARD, EUGENE A. RHOADS, A. WELLS ROBINSON, GEORGE N. BELL, JOSEPH POWELL, JR., and GRIFFITH W. JONES. The Secretary presented, for Mr. THEO. LOW, "Notes on Railroad Construction." The paper treats of detail in the management of surveys and plans, forms of note books, methods of accurate measures for bridge work coffer-dams, etc. It embodies many excellent suggestions as to practical details. Mr. F. W. WHITING, introduced by Mr. L. C. MADEIRA, JR., presented a paper upon the "Prevention of the Spreading of Fires," treating especially of the relation of the proper and scientific design and construction of buildings to their safety from entire destruction in case of the starting of a fire within them. Mr. FRANCIS LIGHTFOOT, introduced by Mr. J. KAY LITTLE, exhibited and described a stamp splice, tongue and groove rail joint, devised by him.

The ends of the rails are stamped, at the heat at which they leave the last roll, into such shape that they will halve over or against each other, and sustain each other by an arrangement of tongues and grooves. They are simply bolted together without any additional plate or fixture. They have been laid on a portion of the Pennsylvania Railroad, where they are being subjected to severe test. The inventor claims that the test, to date, has been entirely successful, and that many advantages have been obtained over other forms of joint.

Mr. MAX LIVINGSTON presented a paper on Petroleum.

Engineer's Club of St. Louis.—At the meeting of April 6, S. BENT RUSSELL read a paper on "Draining and Filling Water Mains," describing the system of operating in use in the city, where shut-offs average one per day. The difficulties met with and the precautions to be taken were duly treated upon. In the discussion Mr. HOLMAN gave some interesting points in his experience bearing on this question.

Prof. C. M. WOODWARD opened the discussion on the failure of the Bussey bridge on the Providence & Boston railroad, describing fully the nature of the accident and illustrating the details by sketches on the blackboard. His explanation of the cause of the accident was full and clear. The matter was also discussed by Messrs. SEDDON, FEITH, JOHNSON and MOORE. The recent full publications and illustrations in ENGINEERING NEWS were favorably commented upon, and constituted the basis of the discussion.

Liverpool Engineering Society.—The usual fortnightly meeting of the above society was held at the Royal Institution, Colquitt street, on Wednesday evening, April 6, the President, Mr. JOHN J. WEBSTER, M. Inst. C. E., being in the chair, when a paper was read by Mr. J. J. CAMPBELL, entitled "Compound Engines for Atlantic Navigation." The author having described the principal types of engine hitherto employed on Atlantic steamers then spoke of the large consumption of coal in these vessels as compared with others, proceeded to express his opinions on the chief causes of it, especially insufficient expansion from the engines being too small for their power, and pointed out that in the increase in pressure and piston speed adopted of late years had been utilized almost exclusively in obtaining more power in proportion to size and not in producing economy of fuel. Having indicated some of the defects in existing types of engines, the author exhibited several combined diagrams from the engines of Atlantic and other steamers, and described the various methods in use for combining indicator cards advocating the system recommended by Mr. SCHONHEYDER at Middleborough, and showing its advantages over the others. He then described a type of six cylinder, three-crank Quadruple Expansion Engine, which he had spoken of at the summer meeting of the Institution of Naval Architects, as being, in his opinion, the best for large Atlantic steamers, and exhibited drawings showing their special features, indicating the various points in which he considered it to possess advantages over the types of engines now in use or proposed.

PERSONAL.

FRED. J. H. RICKON, City Engineer, of Little Rock, Ark., was, on April 11, unanimously re-elected City Engineer, for his third term.

SAMUEL CRAIG, of Wapakoneta, O., has been appointed to a position as engineer on the Belt Railroad at Findlay, O.

GEORGE W. ROSE has been appointed City Engineer of Fargo, Dak., vice J. D. WHITE, whose term has expired.

F. M. FONDA, General Superintendent of the Georgia Central R. R., was accidentally shot and killed at Savannah, Ga., April 17.

WILSON CROSY, of New York, has been appointed by the Consolidated Railroad Co. Chief Engineer of the new Asylum street bridge improvement at Hartford, Conn. The contract will be awarded shortly.

EDWARD KENDALL, GEO. F. KENDALL, and JAMES H. KENDALL have formed a partnership under the firm name of EDWARD KENDALL & SONS, to continue the business heretofore carried on by the firm of KENDALL & ROBERTS, who are advertised in our columns. The new firm will continue at the same address: 72 to 92 Main street, Cambridgeport, Mass.

R. P. MCCORMICK, contractor for the Kansas City tunnel, will be in New York about 25th inst. to buy outfit for tunnel, and can be found at the office of ENGINEERING NEWS, Tribune Building, New York, on or about that date.

Lieut. JOHN W. DANENHOWER, U. S. N., of Arctic fame, committed suicide, by shooting, in his quarters at Annapolis, Md., on April 20. Lieut. DANENHOWER was 37 years of age; entered the naval service from Illinois in 1866, and first found fame in connection with the ill-fated Jeanette expedition which sailed from San Francisco, July 8, 1879, on a North Polar search by way of Behring's Straits. That story is too well known to need repetition; since 1884 he has been on duty at Annapolis as Assistant Commandant of Cadets. He had been troubled mentally since his return from the Arctic regions, and of late his old malady had reappeared, with the sad result recorded.

TECHNICAL NOTES.

Mayor HEWITT has made an extraordinary statement, that his firm, when engaged in the manufacture of street car rails, was called upon to invent, and did invent and make in large quantities, rails devised for the express purpose of rendering the track inconvenient for the passage of teams. His declaration is reinforced by that of a manufacturer now engaged in the business, who says that the same purpose is still entertained and carried out on nearly all the principal lines in this city and Brooklyn.

This rail was the "center-bearing" rail which presents a deep beveled edge on the outside, making a groove between it and the pavement, that grows constantly deeper and more difficult to escape from without twisting the spokes out of a wheel or breaking an axle. As if this were not bad enough it is an admitted fact that the car companies habitually lay the pavement on both sides of the rail, and especially on the inside, from an inch to an inch and a half above the surface of the rail, making the ruts—eight in all for a double track—still more perilous.

METHOD OF ASCERTAINING THE THICKNESS OF BOILER-PLATES.—The *Illustrite Zeitung fur Blechindustrie* calls attention to a method discovered by M. LEBATEUR for defining the thickness of boiler-plates or other objects where it is difficult to arrive at this information without actual measurement. He spreads a layer of tallow $\frac{1}{10}$ of an inch in thickness upon the metal, and a similar layer upon a piece of known thickness. Both are then subjected for a certain time to the action of a small heated instrument, resembling that used by medical men in cauterization. The tallow melts, and as thick metal is a better conductor of heat than thin metal, the tallow melted upon the thicker plate occupies a greater space than that on the thinner sheet. From the appearance of the two plates the relative thickness is then calculated.

THE Massachusetts Institute of Technology will hold entrance examinations this year on June 2, 3, at Fifth Avenue Hotel, New York, in Boston, Philadelphia, Montreal, Chicago, St. Louis, Cincinnati, San Francisco, Washington, Nashville, St. Paul, Atlanta and Pittsburg, 14 cities in all.

THE Pashinin liquid fuel furnace, adopted last autumn by the Russian Government, for 1 lb. of petroleum refuse burned evaporates 15.6 lbs. of water, or 2¼ times more than coal. During the trials a sheet of white paper held 14 in. above the stack showed no trace of soot. The price of this fuel at Baku is 4 d. or 8 cts. per ton. No detail is given.

THERE are now on the books of the Institution of Civil Engineers 1,568 members, 2,275 associate members, 20 honorary members, 484 associates, and 949 students—an increase of 196 in the past twelve months.

JUDGE BARCLAY, of St. Louis, has ruled, in the case of the New York Central Sleeping Car Co. *vs.* Root, where money was taken from a vest while the owner was in the wash-room, as follows:

"Sleeping car companies are not insurers of the safety of valuables that passengers may have, or of the passengers' money or property, but by the very nature of their dealings with the public they are to be considered as giving an assurance to those who patronize them that while the passengers are asleep the company will exercise such ordinary care as the circumstances appear to require to protect the passengers against thefts. Nor does this duty end when the passenger awakes. It certainly includes the exercise of similar care on the company's part until the passenger has fully dressed and availed himself of the toilet conveniences, the use of which is part of the consideration or agreement between the company and the passenger."

THE following revised and advanced list of wrought-iron pipe was adopted by the manufacturers, March 23, 1887. The discounts remain without change:

	Inside diameter, nominal.	Price per foot, plain.	Price per foot, galvanized.
Butt welded.	⅛	.04	.05
	¼	.04	.05
	⅜	.04	.05½
	½	.05	.07
	¾	.07	.09
	1	.09½	.12½
	1¼	.12½	.17
Lap welded.	1½	.22	.25
	2	.28	.32
	2½	.44	.49
	3	.58	.64
	3½	.70	.86
	4	.85	1.00
	4½	1.00	1.25
	5	1.20	1.50
	6	1.65	2.00
	7	2.00	....
	8	2.75	....
	9	3.70	....
	10	4.75	....
	11	5.75	....
	12	6.50	....
	13	7.75	....
	14	9.00	....
	15	10.00	....

The revised list for wrought-iron extra strong and double extra strong pipe is as follows:

	Size.	Price per foot, extra strong.	Price per foot, double extra strong.
Butt welded.	⅛	.08	.16
	¼	.08	.16
	⅜	.08	.16
	½	.10	.20
	¾	.14	.28
	1	.19	.38
	1¼	.25	.50
Lap welded.	1½	.44	.88
	2	.56	1.12
	2½	.88	1.76
	3	1.16	2.32
	3½	1.40	2.80
	4	1.70	3.40
	5	2.40	4.80
	6	3.30	6.60

CONSTRUCTION NEWS.

Water.

Bartow, Fla.—Dr. J. A. CLOUD, of Jacksonville, has made a proposition to put in water-works and an electric light system for $15,000.

Greensburg, Pa.—The Board of Burgesses has received propositions for a water supply from the Greensburg Water-Works Co., and the Westmoreland Water-Works Co. The proposition of the latter company has been accepted, and work will be commenced at once.

Artesian Wells.—At Huron, Cal., a company has been organized to sink an artesian well to a depth of 1,000 ft.——The receivers of the Texas & Pacific R. R have let contracts for sinking artesian wells in the dry districts to see whether water can be obtained in sufficient quantities for irrigation; if not, then pumps will be tried and if both fail it is said that agriculture in those districts must be abandoned.

Middletown, Del.—A water-works system is to be established at a cost of from $15,000 to $20,000; the supply will probably be taken from driven wells. Prof. R. A. CAIRNS, of the Rensselaer Polytechnic Institute, Troy, N. Y., has been appointed Chief Engineer, and A. C. STILES, also of the Polytechnic Institute, Assistant Engineer and Superintendent in Charge of Construction.

Irrigation in Colorado.—SAMUEL ALDIS, of Roxbury, Mass., has been engaged at Denver, Col., in completing negotiations for the construction of a large ditch for irrigating the district east of the city. A company has been formed in Denver with a capital stock of $2,500,000 to carry out the enterprise. The ditch will run from near the Greely ditch south and east to about ten miles from Denver, then south and west to the divide, about 50 miles from the city; here a gap of ten miles will be left and the ditch carried on to the Arkansas, near Pueblo. The ditch will be 175 miles long, ten feet wide and three to four feet deep.

The Culbertson Canal & Water Supply Co. has been incorporated at Omaha, Neb., by A. D. KING, C. G. CREW, M. M. HOUSE, and others. Capital stock, $40,000. The company will build a system of canals for water supply and irrigating purposes along the Republican river from Culbertson to Indianola, and on the Frenchmen fork from Beverly to Culbertson.

Washington, D. C.—Breaks in the water mains, caused by the settling of the pipe in made ground over a marsh, recently resulted in a water famine over a considerable portion of Capitol Hill and the northwest. In some cases water had to be fetched from the lower sections of the city, where the supply was not interfered with. Jackets were put on the pipes at the broken parts as a temporary expedient. The streets will have to be torn up and the mains relaid.

Irrigation.—On the Sweet Water river a masonry dam is being built, ten miles from San Diego, Cal., and six miles from National City: this will form a large reservoir, from which the water will be carried in iron pipes to National City to irrigate 30,000 acres of land. The pipe will be laid by July. Col. WILLIAM DICKINSON, Superintendent of the San Diego Land & Town Co., is at the head of the enterprise.

Asheville, N. C.—The water-works are now under construction, and are to be completed by May. The supply is taken from the Swannanoa river, and forced four miles to an iron stand-pipe with a capacity of 700,000 galls.; it is 430 ft. above the river and 235 ft. above the city. The duplex pump has a capacity of 300,000 galls. per ten hours, and is driven by a turbine, the power being obtained by means of a masonry dam in the river. The cost will be between $60,000 and $70,000.

Rockaway Beach, L. I.—The Queens County Water Co. has commenced work on the extension of the Far Rockaway system to the beach. The extension will be an eighth of a mile long, with an auxiliary water-tower at the beach, 20 ft. diameter and 130 ft. high. The company will receive $2,000 per annum for ten years for hydrants. The cost will be between $60,000 and $70,000. The work is in charge of ROBERT F. MULLINS, who was engineer for, and is one of the owners of the Far Rockaway works.

Water Meter Tests.—The following is a list of the entries for the tests of water meters to be made under the supervision of the Water Board, Boston, Mass.: Balance Valve Water Meter Co., Boston; Gorham Gray, Boston; Spooner Diaphragm Water Meter Co., Boston; Pierce & Freeman, Boston; Hersey Meter Co., Boston; Union Water Meter Co., Worcester; Trask Water Meter Co., Syracuse, N. Y.; Thornton N. Motley, New York; R. C. Barron, Salem; National Meter Co., New York; N. F. Wood, Cleveland, O.; F. W. Hood, Wellesley Hills, Mass.; George W. Pierce, Boston; Continental Water Meter Co., Boston; L. P. Hawkins, Boston; Star Water Meter Co., Boston; Hurst Water Meter, Boston; E. C. Terry, Hartford, Conn.; W. E. Draper & Co., Worcester, Mass.; Equitable Water Meter Co., Boston; D. A. Sutherland, Lynn; J. D. Cremain, New York; James Dooling, Boston; J. L. Steinmetz, Lancaster, Pa.; J. Herbert Shedd, Providence; R. J. Rogers, Boston; J. Johnson, Lowell.

Brooklyn, N. Y.—Mayor WHITNEY has called the attention of the Aldermen to the need of prompt action on their part in the matter of the proposed extension of the water-works. The daily supply is reported to be so little in excess of the normal demand that there are grave apprehensions of a water famine in any time of drought.

Camden, N. J.—It is reported that there are grounds for apprehension as to insufficient water supply in the summer. The city has grown so rapidly that the old plant can hardly keep up to the ordinary daily demands. There are two pumps at the works at Pavonia, a modern one of 5,000,000 gals. daily capacity that has been in use for five years, and an old engine of 2,500,000 gals. daily capacity. The daily consumption in February was 5,600,000 gals., and with the hot weather this is expected to increase to 8,000,000 gals. Should any accident happen to the engines there would be a severe famine. There is also lack of reservoir capacity, there being but one reservoir, with a capacity of 7,500,000 gals. More pumps and reservoirs are needed, and it is expected that in the future the works will have to be located elsewhere, and a new source of supply obtained.

New Water Works.—Salem, Ore. The Salem Water Co. has awarded a contract to a San Francisco firm for three miles of iron pipe and an additional pumping engine with a daily capacity of 6,000,000 gals.: all the old wooden mains will be replaced with iron.——Seneca Falls, N. Y. Work has commenced on the water-works.——Braintree, Mass. The town has voted to indefinitely postpone the water question.——Cohoes, N. Y. The Assembly has passed the bill for a water supply.——Eugene City, Ore. The water-works are ready to be put in operation.——Plattsmouth, Neb. The water-works have been tested with satisfactory results.——Palatka, Fla. The works will soon be ready for operation.——Waterville, Me. The town has contracted with the water company for 50 hydrants for 20 years at $2,000 per annum.——Calvert, Tex. The works are about completed.——Sumter, S. C. Two propositions for water-works have been received by the Council.——South Evanston, Ill. A water supply is to be obtained from the Evanston water-works.——Raleigh, N. C. Work has been commenced on the water tower for the new works.——Greenville, Pa. Works are under construction.——Cleveland, O. The Water Board will construct the new tunnel for the pumping station to the lake intake crib this season.——Norfolk, Va. The Lake Drummond Water Co. has made a proposition to furnish an increased water-supply.——Rockland, Mass. The hydrants on the new system of water-works have been tested.——Omaha, Neb. A pumping station will be erected in the village of Florence, up the river.——Sauk Rapids, Minn. Bonds for $40,000 are to be issued to improve the water power.——Little Falls, N. Y. Trenching has been commenced and the works will be completed in the fall.——Waxahachie, Tex. A committee has been appointed to investigate the question of water-works and decide whether the supply shall be taken from springs or artesian wells.——Baton Rouge, La. The proposition of H. S. RAYMOND, of Chicago, to put in water-works, has been accepted.——Asbury Park, N. J. The water system is to be improved; bonds for $10,000 will be issued.——Carlyle, Ill. The works are progressing rapidly.——Lawrence, Kan. The works are completed; there are 14 miles 600 ft. of pipe and a stand pipe 100 ft. high.——Ashland, Ore. The new works are under construction.——Westfield, Mass. A new reservoir is proposed; it will have a capacity of 400,000,000 gals. and will cost $15,000.——Rochester, Minn. Work has been commenced and is to be completed by July.——Drummondville, P. Q. Messrs. CONTOIS & POIRIER will put in water-works.

Chautauqua, N. Y. Address the Executive Committee of the Trustees.——Marhsall, Tex. Address the New York Contract Co., New York.——Newport, Me. Address Judge Bishop.——Waynesburg, Pa. Address J. M. Singerley.——Lagrange, Tex. Address J. C. Brown, President, Lagrange Water-Works Co.——Lowville, N. Y.——Ogallala, Neb.——Hallowell, Mass.——Clinton, Ill.——Vinton, Ia.——Portland, Ind.——St. Johns, P. Q.——Simcoe, Ont.——Berlin, Ont.

Proposals Open.

Pumping Engine and Boiler.—Daily capacity from 15,000,000 to 20,000,000 gals. Specifications adopted. To be advertised shortly. THE WATER COMMISSIONERS, Buffalo, N. Y.

Brick Paving.—On Wick avenue. J. M. RENO, City Engineer, Youngstown, O.

Well Drilling.—H. D. WADDELL, Secretary, Highland Natural Gas Co., Hillsboro, O.

Adams County Oil & Gas Co., Manchester, O.

Depot.—Brick depot at Kinsley, Kan. W. W. OSBORN, Superintendent Railway and Bridges, Atchison, Topeka & Santa Fé R. R. Topeka, Kan.

Court House.—Architects' competitive plans. JOHN R. DILLON, County Clerk, Savannah, Ga.

Water Works.—Plans and specifications at the office of JOHN RENKAWITZ, City Engineer. HARVEY R. HARRIS, President of the Water Board, Michigan City, Ind. April 25.

Sewers.—Furnishing and laying earthenware sewer pipe, 6 ins. to 24 ins. diam. Separate bids. JOHN H. EVANS, Controller, Oil City, Pa. April 25.

Buildings.—Two brick engine houses. Plans and specifications at the office of H. E. HAND, architect, Drake block. REUBEN WARNER, President, Board of Fire Commissioners, St. Paul, Minn. April 25.

Dredging.—About 5,000 cu. yds., at Toronto harbor. MORGAN BALDWIN, Harbor Master, Toronto, Canada. April 25.

At harbor docks and middle branch. N. H. HUTTON, Engineer of Harbor Board, Baltimore, Md. April 25.

Gravel and Sand.—Screened gravel, unscreened gravel, sand, beach sand, Newburyport sand. Separate bids. JOHN W. MCDONALD, Superintendent of Streets, Boston, Mass. April 25.

City Supplies.—Gravel, granite flagstone crossings, ligonier stone blocks, crushed stone, rubber hose, sprinkling carts, street sweeping machines, repairing vulcanite pavement, sewer and gutter castings. E. M. BIGELOW, City Engineer, Pittsburg, Pa. April 25

Steam Road Roller.—One Aveling portable steam roller. E. M. BIGELOW, City Engineer, Pittsburg, Pa. April 25.

Electric Lighting.—Streets, parks, piers, etc., for one year from May 1, 1887. THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers street, New York City. April 26.

Water-Works Supplies.—Pipe, castings, valves, hydrants, etc. Plans and specifications at the Mayor's office, Gloucester, and at the office of FOWLER & LUMMIS, 436 Walnut street, Philadelphia. THE COMMITTEE FOR THE EXTENSION OF THE PIPE SYSTEM, City Hall, Gloucester, N. J. April 26.

Cement.—About 2,000 barrels of Norton's, New York and Rosendale, or Hoffman's cement; bids per barrel. JOSEPH SPEER, County Controller, Pittsburg, Pa. April 27.

Sewer.—Plans and specifications at the office of C. G. FORCE, City Engineer. THE BOARD OF IMPROVEMENTS, Cleveland, O. April 28.

Hauling Pipe.—Hauling and distributing 30-in. cast-iron pipe. Specifications at the Trustees' office on April 25. JAMES SPILMAN, Secretary, Trustees of Covington Reservoir, First National Bank Covington, Ky. April 29.

Broken Stone.—Ohio river limestone, 3,000 perches. THOS. G. SMITH, President, Board of Public Affairs, Cincinnati, O. April 30.

Life Saving Station.—At Cape Lookout, N. C. S. I. KIMBALL, General Superintendent, U. S. Life Saving Service, Treasury Department, Washington, D. C. April 30.

Street Work.—Grading, draining and improving Oak street. Plans and specifications at the office of J. M. RENO, City Engineer. THE CITY CLERK, Youngstown, O. April 30.

Curbing, Flagging and Paving.—THOS. J. LANAHAN, Clerk, Board of Contract & Apportionment, Albany, N. Y. May 2.

Sewers.—THE COMMISSIONER OF PUBLIC WORKS, 31 Chambers street, New York City. May 2.

Street Work.—Regulating and paving with granite and trap blocks. THE COMMISSIONER OF PUBLIC WORKS, New York City. May 2.

Stone.—For lock in the Kentucky river near Oregon, Ky; 10,330 cu. yds. Major JAMES C. POST, U. S. Engineer Office, Cincinnati, O. May 2.

Building.—Bank building. Architect, L. B. WHEELER, Atlanta, Ga. C. D. WOODSON, President, First National Bank, Sheffield, Ala. May 3.

Boilers.—Specifications and plans at the office of the City Engineer. H. T. ROCKWELL, Chairman, Water Board, Boston, Mass. May 3.

Court House and Jail.—Architect, WM. QUAYLE, Cheesman block, Denver. J. E. DUBOIS, County Clerk, Fort Collins, Col. May 4.

Street Crossings.—Stone, asphaltum blocks, and fire brick. A. C. MCKEE, Secretary, Highway Committee, Harrisburg, Pa. May 6.

Stone.—For lock in the Little Kanawha river, near Burning Springs, W. Va.; 1,000 cu. yds. Major JAMES C. POST, U. S. Engineer Office, Cincinnati, O. May 11.

Dredging.—A channel for lake vessels in St. Louis Bay, Minn. O. H. SIMONDS, West Duluth Land Co., Duluth, Minn. May 12.

Machinery for Hydraulic Dredge.—Centrifugal pump, capable of raising 6,000 gals. per minute to a height of 25 ft., with suction pipe and stirring apparatus; discharge pipes to a distance of 550 ft. and a

height of 20 ft. Capt. E. H. RUFFNER, U. S. Engineer Office, Quincy, Ill. May 14.

Steam Heating Apparatus.—THE BOARD OF PENITENTIARY COMMISSIONERS, Little Rock, Ark. June 6.

Contracting.

Cleveland, Akron & Columbus R. R.—The contract for the grading, masonry, tunneling, timber work, track laying and ballasting on the Dresden branch has been awarded to Messrs. Paige, Carey & Co., of Akron, O. JAMES HARRINGTON, of Akron, is Chief Engineer. (For other contracts see p. 258.)

Tunnel.—R. P. McCormick & Co., of Kansas City, Mo., have been awarded the contract for the construction of a double track tunnel, 1,000 ft. long, for the Kansas City Elevated Ry. Co. The outfit will be purchased in New York. The tunnel is to be ready for the track by September.

Sewers.—The following proposals for sewers have been received at Newark, O.: Babbit & Rees, Columbus, O., $12,118; J. T. Murray, Newark, O., $13,700; D. F. Minehan, Springfield, O., $14,267.50; Thos. J. Hirst, Newark, O., $15,626; Dickinson & White, Newark, O. $16,500.

Brick Paving.—City Engineer W. M. RENO, of Youngstown, O., has issued specifications for laying vitrified fire clay brick, with curbing, corner stones, cross walks, catch basins, agricultural tile, etc. The work to be done is on Wick avenue. Proposals are being received.

Water Meters.—The following proposals were opened April 16 by WILLIAM LUDLOW, Engineer Commissioner, Washington, D. C.: National Meter Co., New York City; (Crown) 4, 3, 2, 1½, 1, ¾ and ⅝-in., $302, $151, $76, —, $30.50, $22.75, $13.75. (Empire) $213, no bid, $47.25, no bid, $25.75, $19.37, $13. (Gem) 4, 3 and 2 in., $198, $99, $49.50.——Union Water Meter Co., Worcester, Mass.; $200, $100, $60, $40, $25, $18, $12.——Terry Piston Water Meter Co., New Haven, Conn.; (Terry Piston) $190, $95, $60, $42, $26, $18, $12.——Thornton N. Motley, New York City; (Thomson) 1, ¾ and ⅝-in., $26.25, $20.19, $12.11.——H. R. Worthington, New York City; $245, $79, $36, $32 $25, $17.75, $11.25.

Railroad Contracts.—C. P. Treat, Fremont, Neb., has contracts for grading the Fremont, Elkhorn & Missouri Valley line, for the Chicago & Northwestern Ry. Co., from Linwood to Hastings, 103 miles. Also for the Omaha extension, for the same company, from Arlington to Omaha, 26 miles. The latter is heavy for prairie work, averaging 60,000 cu. yds. per mile; the other is light work and will not last long. There are 500 teams at work on each line.

Shepard, Winston & Co., St. Paul, Minn., have been awarded the contract for the extension of the Chicago, Milwaukee & St. Paul R. R. from Albany, Wis., to New Glarus, 18 miles. The work is to be completed by July 4.

McArthur Bros., Chicago, have been awarded the contract for the Atchison, Topeka & Santa Fé R. R. extension from Galesburg, Ill., to Streator.

W. J. W. Worthington & Co., Birmingham, Ala., have been awarded the contract for a branch of the Kansas City, Memphis & Birmingham R. R., from Ensley City to Bessemer, Ala.

J. B. Reilley & Co. have a sub-contract under S. D. Goodin & Co., for the construction of two miles of the Maysville & Big Sandy R. R., between Augusta, Ky., and Rockspring.

D. Shanahan & Co. have a contract for the construction of the Ohio & Northwestern R. R., between Gallipolis and Portsmouth, O.

McCarthy & Co. have the contract for 100 miles of the extension of the Missouri Pacific R. R. from Van Buren, Ark., to Arkansas City, Kan.

M. V. McCracken has a contract on the Louisville, Cincinnati & Dayton R. R.

D. D. Streeter and J. W. McMurtree, of Lincoln, Neb., have been awarded a contract for the construction of 84 miles of the St. Joseph & Grand Island R. R., between Alma and Fairfield.

The Victor-McNaughton Co., of New York, has been awarded the contract for the construction of the Allegheny Electric Ry.; the road is to be completed by August.

The contracts will soon be let for the construction of the new line from the Poughkeepsie bridge to the Hartford & Connecticut Western R. R. at Jackson Corners, N. Y.; 28 miles.

Dwelling and Well. The following proposals for keeper's dwelling, oil house, etc., and for a well, at North Point, Milwaukee, Wis., were opened April 16, by Lieut. Col. S. M. MANSFIELD, U. S. Light House Engineer, Detroit, Mich.: Chas. Diem, Albion, N. Y., buildings, $4,167.40; well, $275; total, $4,442.40.——Bentley & Strachota, Milwaukee, Wis.: $4,575, $315, $4,890.——John F. Arnott, Sault Ste. Marie, Mich., $4,995, $495, $5,490.——Daniel Boehmer, Manitowoc, Wis.; $5,970, $500, $6,470.——W. T. Casgrain, Milwaukee, Wis.; $7,495, $490, $7,985.——Edward Murphy, New York; buildings only, $7,500.

Lead Pipe.—At St. Paul, Minn., the Water Board has awarded the contract for lead pipe to H. C. McNair at $5.15 per cwt.

Sewers.—During the year about six miles of sewers, from 3 ft. to 8 ft. in diameter, will be built at Pittsburg, Pa. They are to be of brick and stone and will cost $400,000. Address S. D. WARMCASTLE.

Steel Works.—The Pennsylvania Steel Co., Philadelphia, Pa., will establish extensive steel works at Holly Grove, near Baltimore; the site comprises 1,000 acres, and a railroad will be built to connect with main lines in the neighborhood.

Pipe Felting.—The Treasury Department has awarded a contract for about 9,000 sq. ft. of felt covering for steam and water pipe to the Chalmer Spence Co., of Philadelphia, Pa., at $2,070. The bid was not the lowest but the quality of the material was taken into account.

The Volker & Felthousen Manufacturing Co., Buffalo, N. Y., reports orders for six water-works pumps, in addition to the usual small pump trade. The factory is running 13 hours a day and an order has been placed for a large quantity of new tools.

The Spiral Weld Tube Co. has been organized with JAMES C. BAYLES, President of the Board of Health, New York City, at the head of the enterprise. The temporary works are at Greenpoint, N. Y., but work has been commenced on a factory at East Orange, N. J. The capital stock is $250,000.

The Colorado & Texas Railway Construction Co. has been incorporated at Des Moines, Ia., by G. M. DODGE, J. B. HOUSTON and others. Capital stock $4,000,000, with power to increase to $10 000,000. The company will build a line from Pueblo, Col., to the Texas State line, to connect with the line being built north from Fort Worth, Tex., as a part of the Fort Worth & Denver City system. The company will also build a line from Boone, Ia., to Clear Lake.

Harbor Work.—The following proposals have been received by Capt. W. M. BLACK, U. S. Engineer Office, Jacksonville, Fla.: Improving Manatee river; S. N. Kimball, dredging, 50 cts. per cu. yd.——Improving harbor at Cedar Keys; S. N. Kimball, dredging, 47.5 cts. per cu. yd.——Improving harbor at Tampa bay; S. N. Kimball, dredging, 44 cts. per cu. yd.; rock excavation, $6.90; John Maguire, no bid, $5.90.

Chattanooga Street Improvement.—The Tennessee Legislature has passed a bill authorizing the city of Chattanooga to issue $500,000 in bonds to improve the streets and build sewers. A correspondent tells us however, that the citizens seem to take little interest in the matter, as out of a claimed population of 35,000 only 1,484 votes, were recently cast for the election of a board of public works.

Canal.—The contract for a canal in Garrett township, Ill., has been awarded to Pollard & Goff, who constructed the Lake Fork canal in Champaign and Piatt counties. The Garrett canal will be 15 miles long, 24 ft. wide and 10 ft. deep; there will be 35 miles of laterals. The entire cost will be about $30,000 and the work is to be completed within a year.

Street Cleaning.—The following proposals have been received for cleaning the streets at Chicago, Ill.; John S. Cooper, $23.99 per mile if he furnishes the sweeping machinery; or $23 per mile if the city furnishes it. R.F. Conway, $24.69, $23.19. Downey, Kinsella & Co., $24.85, $23.19. C. T. Hotchkiss, $27, $25. William C. Walsh, $34, he to furnish the plant. The contract was awarded to John S. Cooper, who had the contract last year at $24.89 per mile. There are about 3,500 miles of streets to be cleaned this year.

The lowest bid for cleaning streets at Brooklyn, N.Y., was from Crawford & Valentine; removing ashes, for first, second and third year, $130,000, $140,000, $150,000; cleaning streets, $25 per mile.

The National Street Sweeping Machinery Co.—This company was organized in Philadelphia, April 13, 1887, with headquarters at 330 Walnut St. Its officers are—TATNALL PAULDING, President; Gen. LEWIS MERRILL, Vice-President and General Manager, and THOS. P. HOWELL, Secretary. The company owns the patents for the Reynolds gutter-sweeper and combined loader and sweeper (see ENGINEERING NEWS, April 24, 1886) and is now prepared to treat with contractors and city authorities, who may wish to test or use these machines. This sweeper is a radical advance on prevailing methods, reducing the cost of this character of work from 40 to 50 per cent. below usual cost; hand-labor is entirely dispensed with in piling and loading the dirt, while the machine itself is simple, strongly built and needing a minimum of repair. The draught on the horse is lighter than with almost any other machine, and the machine itself is available for use on rough and unevenly-laid pavements. The tests so far made would seem to indicate that this machine is destined to satisfactorily solve the interesting problem of keeping streets clean at a reasonable cost.

Piers.—The Norfolk Terminal Co., of Norfolk, Va., will build a large pier for coal and iron ore.

Steel.—The Secretary of the Navy has awarded the contracts for 1,400 tons of gun forgings and 4,500 tons of armor plate to the Bethlehem Iron Works, Bethlehem, Pa., at a total of $4,512,938.29.

Steel Rails.—The Lake Erie & Western R. R. Co. has awarded a contract for 2,000 tons of steel rails, to be delivered in May, to the Indianapolis Steel Rail Mill Co. The rails are for the Michigan City division.

Cable Railway.—Contracts have been awarded as follows by JULIUS WALSH, President of the Citizens' Railway Co., St. Louis, Mo.: Cast-iron yokes; McMurray, Judge & Co., G. F. Filley and another St. Louis firm. Rails; girder rails, 63 lbs. per yd., Cambria Iron Co., Johnstown, Pa., (O. W. Meysenburg, St. Louis, agent). The Laclede Gas Light Co. offers to remove all obstructing gas pipes for $17,000.

Sand and Sidewalk Repairs.—The following proposals were opened April 18 by the Commissioner of Public Works, New York City: Sand, 1,200 cu. yds. of clean Cow Bay sand for road surfacing: M. Fay, $1.17 per cu. yd.; Wm. McDermott, $1.25. Contract awarded to M. Fay.——Repairing sidewalk at corner of Elm and White streets; G. E. Moore, $1,495.75; J. T. McDonald $1,769.25. Contract awarded to G. E. Moore.

Stone Arch Bridges.—Messrs. Sparks & Evans, of Philadelphia, Pa., have a contract for widening a double track bridge built by them last winter over the Swatara river at Middletown, Pa., for the Pennsylvania R. R., to a four track bridge; there are two spans of 62 ft. and two of 68 ft. 2 ins. They have also the contract for the construction of a four track, stone arch bridge for the Pennsylvania R. R., over the Conemaugh river at Johnstown, Pa.; there will be six spans of 58 ft.

Cordage & Oakum.—Proposals have been received by Major A. MACKENZIE, U. S. Engineer Office, Rock Island, Ill., from W. D. Bangs, St. Louis, Mo.; James J. Hank, St. Louis; Ward & Brady, St. Louis; Geo. B. Carpenter & Co., Chicago; H. Channon & Co., Chicago. The contract was awarded to W. D. Bangs, at the following prices: 13,000 pounds of manilla rope, 11¾ cts. per pound; 14,000 pounds of lath yarn, 8 cts. per pound; 100 bales of oakum, $3.50 per bale; total $2,948.75.

Market.—The following proposals for the construction of the new Gansevoort market, were opened April 18 by the Commissioner of Public Works, New York City: Moran & Armstrong, $477,443; J. McQuade, $485,000; B. Gallagher, $486,500; John Moore, $495,980; F. Agnew, $497,777; J. H. Brady, $499,400; D. C. Week & Son, $514,885; J. H. O'Rourke, $547,845; John Cox & Co., $548,000; B. Sheridan, $553,000. The contract has been awarded to Moran & Armstrong. The building will be located on the block bounded by West, Bloomfield and Gansevoort streets and 13th avenue; it will be of brick, two stories in height, and is to be finished within a year.

Street Work and Sewer.—The following proposals were opened April 18 by the Commissioner of Public Works, New York City: Regulating, grading, curbing and flagging: (1) On 87th street, Jas. Slattery, $230.75. Contract awarded. (2) On 102nd street, P. McInerny, $5,624.59; J. J. Farley, $5,675.64. Contract awarded to P. McInerny. (3) On 103rd street, J. J. Farley, $5,639.45. Contract awarded. (4) On 147th street, J. J. Farley, $4,653.40; Chas. V. Hough, $4,805; B. Mahon, $4,834.16; M. Fay, $5,910.72; Wm. F. Irwin, $5,943.92. Contract awarded to J. J. Farley.——Curbing and flagging: (5) On Coenties slip, Andrew Low, $1,972.40; J. T. McDonald, $2,085. Contract awarded to Andrew Low. (6) On 122nd street, Andrew Low, $1,223.87; P. McInerny, $1,248.50; J. T. McDonald, $1,485. Contract awarded to Andrew Low.——Sewer: (7) On Avenue B, L. Martin, brick sewer, $7.37 per lin. ft.; timber, $45 per M.; total, $1,592.70. P. Kearn, $8, $20, $1,760. Contract awarded to L. Martin.

The Newark Intercepting Sewer.—The large sewer at Newark, N. J., is expected to be completed by May. The sewer is of brick, egg shaped, and varies from 3 ft. to 6 ft. wide; its entire length, from Peddie street to the pumping station on Wheeler Point is 14,500 ft. At the pumping station is a filth hoist, provided with a double tunnel and cages to retain the solid matter; from the pump well, the sewage is pumped up to a height sufficient to allow it to flow into the bay. There are four pumping engines, built by Watts, Campbell & Co., of Newark, which have a daily capacity of 7,500,000 gals each; the present estimated flow of the sewers is 10,000,000 per day; the cylinders are 20 ins. by 36 ins., and the suction main is 36 ins. in diameter. The sewage is discharged through two wooden flumes, 4 ft. square, extending for a distance of two miles, the mouth is at the bottom of the bay, half a mile from the shore. By a connection with the Peddie street ditch, the sewer can be flushed. The estimated cost was $387,000, and the work was to be completed by January, 1887; difficulties in construction have delayed the progress, and the cost has amounted to $531,000. Engineer SCHAEFER is in charge of the work.

Cement.—The following proposals for hydraulic cement for the dry dock at the Des Moines Rapids canal were opened April 15 by Major A. MACKENZIE, U. S. Engineer Office, Rock Island, Ill.: Meacham & Wright, Chicago, Ill.; natural cement, 1,000 bbls., per bbl. of 300 pounds, $1.33 in bbls., $1.03 in bags, (Utica cement): Portland cement, 20 bbls., no bid. James McNamara, Keokuk, Ia., $1.45, $1.25 (Louisville or Milwaukee cement): Portland, $3.75 per bbl. The contract was awarded to Meacham & Wright, delivery in bags accepted.

Excavation.—The following proposals were opened April 15 by the Commission for the Construction of the Congressional Library, Washington, D. C.: Excavation for cellars and areas: Elias E. Barnes, 21 cts. per cu. yd.; Thos. H. Lyon, 26 cts.; Gleason & Steep, 27 cts.; Maloney & Neville, 27 cts.; W. H. Mohler, 27 cts.; Atchison & Murphy, 29½ cts.; W. F. Wheatley, 32½ cts.; John Cudmore, 32½ cts.; John M. Murphy, 32¾ cts.; White & Mullen, 33 cts.; M. F. Talty, 39 cts.; C. H. Langhorn, 45 cts.——Excavation for concrete foundations; Thomas H. Lyon, 43 cts. per cu. yd.; M. F. Talty, 45 cts.; Atchison & Murphy, 49⅛ cts.; White & Mullen, 66 cts.; Gleason & Steep, 69 cts.; C. H. Langhorn, 85 cts.

Water-Works Supplies.—The following proposals have been received by the Water Commissioners, Altoona, Pa.; Pipe, 4-in. and 8-in.; National Foundry & Pipe Works, Scottsdale, Pa., 20 and 47 cts. per ft., $36.60 per ton of 2,000 pounds; specials, 3¼ cts. per pound. Jackson & Woodin Mannfacturing Co., Berwick, Pa., $36.25 and $34.25 per ton, 2.85 cts. Mellert Foundry & Machine Co., Reading, Pa., $36.20 and $33.60, 2¾ cts.—Valves, 4, 6 and 8-in., Mellert Foundry & Machine Co., $10, $15, $24. Bailey, Farrell & Co., Pittsburg, Pa., $9.40, $15.25, $22.75. Eddy Valve Co., Waterford, N. Y., $9, $15.50, $22.25. Walter S. Raynor & Co., Fostoria, O., $8 $13.75, $20. Lehigh Valley Brass Works, Bethlehem, Pa., $8.75, $14.50, $21.50.

Pumping Engine.—The following proposals have been received by the Board of Trustees, Lake View, Ill., for a horizontal, compound, condensing, pumping engine, with a daily capacity of 8,000,000, 10,000,000 or 12,000,000 galls.: Holly Manufacturing Co., Lockport, N. Y.; $32,750, $40,500, $47,500; crank and fly-wheel horizontal, Gordon & Maxwell, Hamilton, O.; $34,000, $47,000, $58,000; crank and fly-wheel horizontal, Henry R. Worthington, New York; 8,000,000 galls., $32,085; two 5,000,000 galls., $32,615; two 6,000,000 galls., $49,780; direct acting, high duty attachment. The contract was awarded to the Holly Manufacturing Co., for the 12,000,000 galls. engine, at $47,500, including foundations. JOHN W. ALVORD is City Engineer.

City Work.—At Richmond, Va., contracts have been awarded as follows by W. E. CUTSHAW, City Engineer: new granite paving, Alois Rick and Thomas Barry, 73 to 77½ cts. per sq. yd.; granite blocks at crossings, etc., Alois Rick, $1.24 per sq. yd.; taking up, relaying and repairing granite and cobblestone paving, W. M. Brown, 26½ cts. per sq. yd.; granite flagging, Richmond Granite Co., 47¼ cts. per sq. ft.; granite curbing, O. N. Hackett, 74 cts. per lin. ft.; granite circular curbing, Hutchem, Johnston & Donald, $1.20 per lin. ft.; granite corner curbing, Virginia State Granite Co., $6.95 each; stones for street basins, complete, J. B. Mitchell & Co., $18; brick paving, A. L. Phillips, 70 cts. per sq. yd.; brick paving in repairs, B. M. Batkins, 25 cts. per sq. yd.; cement, Robert Wendenburg, $1.16 for James river and $1.21 for Rosendale; Akron sewer pipe, West & Branch, 60 per cent. discount off price list; iron castings for street basins, S. R. Davis, $3 each.

Street Cleaning.—The City Commissioner, Albany, N. Y., has awarded contracts as follows: 1st, 2nd and rd districts, Wm. Muckle, $5.15, $4.84 and $5.15 per team per day; 4th and 5th districts, Ezra Bush, $4.74 per team per day each. The highest bid was $6. The work of sweeping the street dirt into heaps in front of each piece of property is done by the owners or occupants on designated days, and after notification by the police. The taking up and removing of the dirt is under the supervision of the police, the contractor furnishing teams and men as required, from time to time, by the Chief of Police.

Governor HILL has signed Assemblyman FARRELL's street cleaning bill, which directs the Board of Estimate of Brooklyn, N. Y., to immediately meet and estimate the amount of money, in addition to that already set apart, required to be expended for street cleaning purposes for the years 1887, 1888 and 1889.

City Work.—A large number of contracts have been awarded at Lake View, Ill. Bids for sewers were received from E. Flannegan, J. E. McNichols, J. Hallanin, M. McNichols, M. J. Healey, Thos. Byrne, J. McDowell and Cleary & McNichols. The prices varied according to the depth of cut, etc., but the following from the Commissioner's estimate will give an approximate idea: Pipe, 20-in., $2.15; 18-in., $1.90; 15-in., $1.80; 12-in., $1.30. Brick, single ring, 24-in., $1.75; double ring, 36, 42, 48, 60 and 66-in., $3.80, $4.20, $4.70, $4.70, $4.50; double invert, 24-in., $2.40; 30-in., $3.40.——Bids for house drains were received from W. M. Dee, Jas. McDowell, Cahan & Byrne, Cleary & McNichols, M. J. Healey and J. E. McNichols; prices ranged from 25 cts. to $1 per ft.——Bids for water service were received from Cahan & Byrne, E. Galloway and Allis Bros.; prices averaged between 30 and 50 cts. per ft., and between 25 and 32 cts. per ft. without stopcock.——Bids for street improvement were received from McAdam & Amburgh, John Duffy & Sons, H. J. McBean & Co., Olaf Vider, R. F. Conway, Lyman & Co., Daly & Sackley, J. B. Smith & Co., La Bounty & Co., Isaac Robinson, R. F. Wilson. In each case the bid of McAdam & Amburgh was the lowest as follows: cedar block, $1.10 per sq. yd.; granite block, 40 cts. and $2.70 per sq. yd.; excavation, 12 and 15 cts. per cu. yd., and 5 cts. for each 1,000 ft. additional haul; wood curbing, 13 cts. per lin. ft. E. TUERNELL is Superintendent of Public Works and J. W. ALVORD, City Engineer. (We have received the complete lists of prices and amounts for the above but they are too volumnious to be reproduced in full.)

Railroads.

Grading and Tracklaying.—*Southern.*—The Charleston & Savannah R. R. is graded to Ravenel, Ga.——Work on the Maysville & Big Sandy R. R. has been delayed by bad weather, but it is hoped to complete it by Sept. 1.

The Georgia Pacific line from Columbus, Miss., to Birmingham, Ala., is completed and in operation.

The Northwest.—Grading on the Chicago, Santa Fé & California R. R. between Galesburg, Ill., and Fort Madison, Ia., is being pushed at all points of the line.——The Chicago, Milwaukee & St. Paul will complete its Bismarck, Dak., extension this season.——The Wisconsin Central R. R. has the track laid on its extension from Mellen Junction to within eight miles of Hurley.——The Minnesota & Northwestern R. R. is extending its double track to South St. Paul.

The Southwest.—The Taylor, Bastrop & Houston branch of the Missouri Pacific is graded to La Grange, Tex.——East Louisiana R. R. Track has been laid to within six miles of Abita Springs, La., and will reach that place by May 15.——Chicago, Milwaukee & St. Paul Ry. Track on the Kansas City extension is completed to Chillicothe, Mo.——Marshall, Paris & Northwestern R. R. Work is to be resumed and pushed to completion JOHN MARTIN, Paris, Tex., is President.

Surveys.—*East of Chicago.*—The Baltimore & Ohio R. R. has surveyed a line from Akron, O., to Chicago Junction, 60 miles.——Southwest Penn. R. R. The extension from Uniontown, Pa., to the State line, near the mouth of Cheat river, is under survey.——Findlay Belt R. R. Right of way has been secured and surveys made. JOSEPH RAMSEY, of the Cincinnati, Hamilton & Dayton R. R. is President.——The Bangor & Piscataquis R. R. will locate the line from Bangor to Milo, Me.

Southern.—The Cumberland Valley branch of the Louisville & Nashville R. R. will be extended east from Pineville, Ky., to meet an extension of the Norfolk & Western R. R., now under survey via the Clinch river valley.——The Mobile & Girard R. R. is surveying for an extension from Troy to Pollard, Ala.

The Northwest.—Location is nearly completed on the Aberdeen, Bismarck & Northwestern R. R.——The Duluth, Fargo & Black Hills Ry. has been granted right of way at Fargo, Dak.——The St. Louis & Chicago R. R. has obtained most of the right of way for its extensions from Springfield, Ill., to Peoria and Joliet and from Litchfield to St. Louis.——Springfield & Southern Illinois R. R. The directors have ordered a survey.

The Southwest.—The Missouri Pacific line from Little Rock, Ark., up the Arkansas valley to Fort Smith, is being located.

New Companies and Projects.—*East of Chicago.*—The Canada Atlantic R. R. proposes to build from Lacolle Junction, P. Q., to Alburgh Springs, Vt., a distance of 12 miles.——South Gosfield, Ont., has voted $60,000 bonus to the Gosfield & Windsor R. R.——The projectors of the Canastota & Earlville R. R. in central New York, now propose an extension to Stanford, Delaware Co.——Elgin, Joliet & Eastern Indiana Ry. Co. Incorporated by CHAS. S. HOLT and others, to build from La Porte, Ind., west 50 miles to the Illinois State line.——Columbus, Lima & Northwestern Ry. Co. To build a line between Columbus and Lima, O. Incorporated by F. P. GRAFF and others.

Southern.—Kanawha & Richmond R. R. Co., WM. S. EDWARDS, Charleston, W. Va., President.——Florida Southern R. R. Extensions are rumored from Micanopy to Wekiwa Springs and from Williston to the Gulf.——A company is organized to build from Dayton to Cleveland, Tenn., H. W. HORNER is Secretary.——A suburban narrow gauge road has been incorporated to build from Memphis, Tenn., to Raleigh Springs. J. T. FERGUSON is interested.——Chattahoochee Valley R. R. Chartered by L. LANIN, West Point, Ga., to run from West Point to Columbus.——The West Virginia Central & Pittsburg R. R. will build an extension from Davis to St. George, W. Va.——The Kansas City, Memphis & Birmingham, R. R., now laying track in northern Mississippi, proposes a branch to Pensacola via Aberdeen and Columbus, Miss.

The Northwest.—Manitoba Central Ry., from Winnipeg via Portage La Prairie to the boundary. DUNCAN MACARTHUR is interested.—— Kankakee, Mendota & Western R. R. Co. Incorporated by FRANK W. CALAIS, Joliet, Ill., and others.

The Southwest.—The Kansas & Gulf Short Line, now owned by the St. Louis, Arkansas & Texas, will be extended from Lufkin, Tex., to the Gulf.——Reyno, Iron Mountain & St. Louis R. R. Co. Chartered by R. T. BROWN, Pocohontas, Ark., and others, to build from Reyno to Corning.——The Denver, Texas, & Fort Worth R. R. Co. has been incorporated at Denver with a capital of $30,000,000, to complete the Denver, Texas & Gulf and Fort Worth & Denver City, forming a through line from Denver to the Gulf. SIDNEY DILLON is President.——Little Rock & Alexandria R. R. Incorporated by B. W. JOHNSON, and others, at Little Rock, Ark.——A line is proposed from Navasota, Tex. to Anderson and Madisonville; $50,000 bonus is offered by the towns.

Bridges, Canals, Etc.

Sault Ste. Marie Canal.—There is considerable discussion at Ottawa over the proposition of the Dominion Government to construct a canal at Sault Ste. Marie. It is stated that the Canadian Pacific Ry. Co. has induced the government to take up the work in the interest of the company's steamship traffic on Lake Superior, in case it should be hampered by the retaliation measure of Congress.

Arcade.—At Cleveland, O., a company has been organized to build an arcade, with fine business blocks on Euclid avenue and Superior street; the passageway between will be covered with glass and contain a number of stores. MYRON T. HERRICK, JOHN ROCKEFELLER, and others, are interested. Capital stock, $600,000.

Bridge Notes.—The Central Vermont R. R. Co. has completed its new Woodstock bridge and trains are again running by way of White River Junction.——The Galveston, Henderson & Houston R. R. Co. is erecting a new bridge across the Buffalo bayou, Tex., at a cost of $80,000.——At Red Lake Falls, Minn., an iron bridge is to be built across the Clearwater river at a cost of $10,000.——At Burlington, Ia., the supervisors propose to erect a bridge over Dry Branch.——At Manchester, N. H., work is progressing on the new single span, double track iron railroad bridge over the Hockanum river.——The Chicago, Rock Island & Pacific R. R. Co. will repair its bridge at Leavenworth, Kan., and make it safe for trains.——Eight iron bridges will be built immediately by Bastrop county, Tex.——The Freeholders of Monmouth county, N. J., propose to erect a bridge near Matawan; Freeholder WM. A. DUNLOP, is interested.——At San Francisco, Cal., a new iron bridge is proposed across the Second street cut at a cost of $9,000 or $10,000; Superintendent of Streets ASHWORTH, stated that the present bridge could be repaired for $2,000.——At Drummondville, P. Q., the Dominion Bridge Co. has completed an iron bridge across the St. Francis river for the Drummond County Railway.——At Lexington, Mo., the St. Louis & St. Joseph R. R. Co. proposes to bridge the river.

Oswego and Erie Canals.—Owing to the severe weather encountered, the contractors on the Erie canal were granted an extension of time to May 1; the rain and frost have injured the embankments, entailing considerable expense for additional excavation. The Oswego canal is being deepened and locks 1, 5 and 6 are being lengthened, all work will be finished before navigation opens. On the Erie canal Hughes Bros. are pushing work on doubling locks 47, 48, 49; locks 51 and 52, at Jordan and Port Byron, are nearly finished. The opening of navigation will probably be late.

The Yukon Expedition.—The Dominion Government has this week sent out an expedition to the Yukon country to locate and make a preliminary survey of the gold fields in northern British Columbia. The expedition is headed by Dr. DAWSON, Assistant Director of the Canadian Geological Survey; Mr. OGILVIE, Dominion Land Surveyor, and two members of the survey staff.

Sea Wall.—The Mayor and Harbor Commissioners of San Francisco, Cal., have decided on the construction of an extension of the sea wall, 1,000 ft. long, and have instructed Chief Engineer MAESDEN MANSON to prepare plans and specifications and to advertise for bids. The engineer's estimate is $134,970.

The Proposed Charles River Bridge, Boston to Cambridge.—The plans for this bridge lately approved by the city government and mayor of Boston cover a deck bridge 2,155 ft. long, 70 ft. wide, with a draw 50 ft. wide, with stone piers and iron superstructure; the spans will be 105 ft., of the cantilever type. $5,000 has been appropriated for plans and surveys; the cost is to be shared by the two cities, Boston being authorized to raise $250,000 for this purpose. As yet the enterprise is in a preliminary stage, as the relative proportion of payment by Boston & Cambridge is not yet settled.